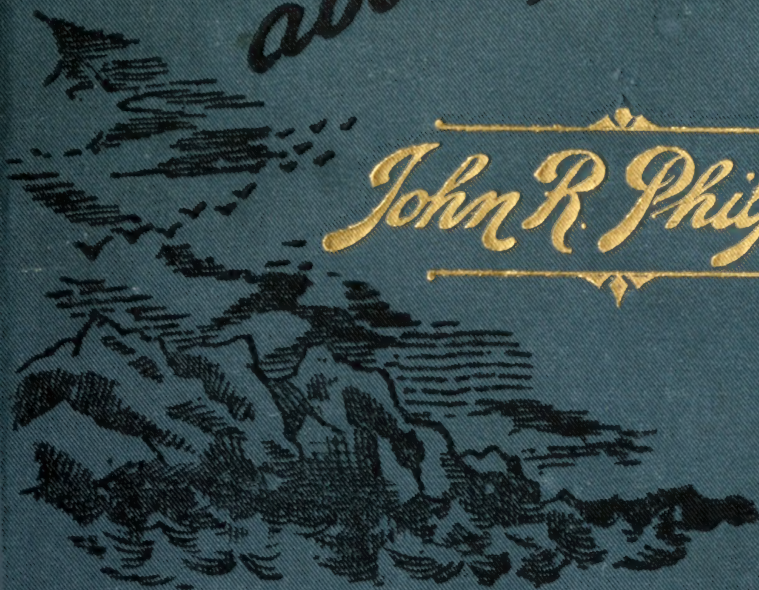




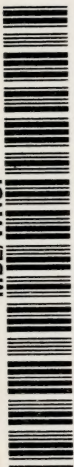
Oysters
and all
about Them.

John R. Philpots.





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OYSTERS,
AND ALL ABOUT THEM.



Leicester, "Provincial Medical Journal" Office.

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OYSTERS,

And all about them.

BEING

115L GIFT - 1788

A complete history of the titular subject,
exhaustive on all points of necessary and
curious information from the Earliest
Writers to those of the Present Time,
with numerous additions, facts, and
notes, by

JOHN R. PHILPOTS,

L.R.C.P. & S. Edin., J.P., &c.



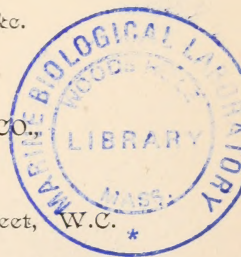
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1890.



DEDICATED

(BY PERMISSION)

TO

PROFESSOR T. H. HUXLEY,

AS A SLIGHT TOKEN OF RESPECT

FOR HIS GREAT LITERARY ATTAINMENTS

AND

MANY VALUABLE CONTRIBUTIONS TO SCIENCE,

BY

HIS SINCERE ADMIRER,

JOHN R. PHILPOTS.

“HAPPY is he who lives to understand,
Not human nature only, but explores
All natures,—to the end that he may find
The law that governs each ; and where begins
The union, the partition where, that makes
Kind and degree, among all visible beings ;
The constitutions, powers, and faculties
Which they inherit—cannot step beyond—
And cannot fall beneath ; that do assign
To every class its station and its office,
Through all the mighty commonwealth of things ;
Up from the creeping plant to sovereign Man.
Such converse, if directed by a meek,
Sincere, and humble spirit, teaches love :
For knowledge is delight ; and such delight
Breeds love : yet, suited as it rather is
To thought and to the climbing intellect,
It teaches less to love, than to adore ;
If that be not indeed the highest love !”

—*Wordsworth.*

PREFACE.

MY object in preparing the present work has been to furnish the reader, and the public in general, with a clear and intelligent description of the titular subject, and to bring the medicinal properties and edible value of the common Oyster more in favour (despite the increasing demand for it) than what with many people it has hitherto obtained. There are thousands of individuals who have never eaten an oyster; who—from nausea aroused through a delicate nervous organism, or, through disgust inspired and influenced by a too sensitive imagination—cannot bring themselves so far as to “screw (their) courage to the sticking point” to venture the attempt: but, once made, the disgust is conquered, and shuddering antipathy becomes natural craving. The taste and the memory thereof continually haunt the appetite of the gastronomical convert while he or she dreams of satisfactory indulgence in the near future. It is upon such of my readers, that I have sought to urge the desirability—nay, the necessity of habitually partaking of the esculent mollusc.

To me the compiling of this book has been a labour of love, and, from a medical point of view, my chief aim in its publication has been prompted by a conscientious feeling of duty and good will towards my fellow man.

What success my book may have I know not, I can only hope that its reception will be favourable ;

“’Tis not in mortals to command success,
But (I’ll endeavour to) deserve it.”

and, should the public deem that I have worthily fulfilled my promise, I shall be content with whatever praise or favour be awarded me. Thus, armed with a good intention, I feel that I have chosen one of those subjects wherein I take the public’s health to be much concerned, and wherein, though I may not be able to inform men more than they know, yet perhaps I may give them occasion to consider more than they do.

Another reason for my undertaking this work has been the long felt want of a combined TEXT-BOOK for the student of Zoology, and a BOOK OF REFERENCE for the general reader, which, with all due deference to the reader’s opinion, I claim mine to be.

True, there are able relative articles in our Magazines, and also Books replete with scientific information, written by some of the foremost Professors of the day ; but the former are merely a conglomeration of curtailed extracts from standard works—instructive, certainly, but as certainly unsatisfactory, on account of their incompleteness—while, on the other hand, although exhaustive, the books are so only in the scientific branch of the subject in question, ignoring that more general information which has long been looked for by a large majority of “Anxious Inquirers,” or where they *do* touch upon the matter it is only in a disappointingly abbreviated form. Hence, I feel justified in saying that what has been a long felt want to *me* has *proved the same* to others, at least, I infer so from the complaint of one of three letters which some time since

appeared in *The Standard*, under the heading of "Oyster Cultivation," and which I quote without abridgment. It is as follows:—

"A letter appeared in one of your late impressions, on the subject of laying down oysters to fatten, and the writer asked why were not the foreshores made more use of? The reason is, I believe, that few people know how to begin, or what to do. There are hundreds of miles of shore that might be made use of, and that would yield a profit exceeding in value the richest crop the land could produce. Will your correspondent, "Native," throw some light on the subject? I have been anxiously looking for information, but can find *no book* or person to give it me. Any person living on the Estuaries or creeks might have his Oyster or Mussel Parc, as so many do abroad."

The italics are mine, and, I am led to hope that the words emphasized corroborate my humble endeavours to meet and supply the demand. And what though this is but only *one* seeker of the needful volume, it is and must be self evident that there are surely many more. With regard to the remark of the above correspondent relative to any person having his own Oyster or Mussel Parc, I think the idea quite practical, but (for reasons explained hereafter) rather Utopian in consummation—that is, in the United Kingdom. Nevertheless, though not exactly living "on an Estuary," I am sufficiently near one, where oysters have been and are still in abundance, to sympathise with him.

Considerable prominence has been given to the scientific division of these bivalves, the greater amount of individual character presented by these requiring that the habits of each species should be fully dwelt upon.

But in addition to the reasons stated for my undertaking this work, I respectfully venture to emphasize the relative inducements culminating in the present volume, and its hoped-for instructive, entertaining, and referential utility to the reading public, by quoting the strictures upon this point of my subject of a vigorous writer in the *Quarterly Review* (vol. 144), who, criticising some "Reports on Oyster Fisheries," says:—

"One cause which has tended to the spoliation of the shoals is the ignorance which has prevailed, and still prevails, of the natural and economic history of fish and crustaceans. Beyond the fact already alluded to of their enormous fecundity, we know almost nothing about them. Fishes and crustaceans have been classified in families or groups, and many of them have been carefully described, and most of them figured and coloured with more or less care. But what, let us ask, is known of their habits of life, their rates of growth, and the age at which they become reproductive. We know very little, indeed, of those features of their lives about which we should know most. . . . It is from want of such knowledge that the public now suffer. The decreasing supplies of lobsters, crabs, and oysters, as well as the marked falling off now apparent in our supplies of both flat and round fish, may be set down to that mal-economy which is born of ignorance and cupidity. What does it matter, for example, to the consumer whether an oyster yields spat sufficient for the production of five hundred or five thousand of its kind, if he does not obtain a share of them? The natural waste of fish-life—and this is a fact that has been too much ignored—is commensurate with the spawning power bestowed upon them. . . . As regards the natural history of the oyster, it is curious that although it is an

animal easy of access, which can be seen and handled all the year round and all day long, we have almost no exact knowledge of its habits, of its real power of reproduction, or of the circumstances which govern the rise and fall of oyster *spat*."

In conclusion, I must record my indebtedness to past and present works, including Reviews and Magazines, together with grateful acknowledgments to living authors, whose names are mentioned with the extracts quoted from their instructive volumes.

My thanks are also due to those friends by whose kind assistance my voluntary and congenial task has been considerably lightened and encouraged; the foremost of whom are Messrs. J. H. Henderson, C. Carus-Wilson, A. J. H. Crespi, F. Slater, and Lieutenant Francis Winslow, of the United States Navy, with others whose names are mentioned in these pages wherever their contributions come into requisition.

Lastly, but by no means least, in tendering my sincere thanks to those by whose kind permission I have been so well enabled to adorn my work, I am especially grateful to Mrs. H. N. Moseley, whose generosity in allowing me to draw *ad libitum* from the valuable work of her eminent father, Dr. John Gwyn Jeffreys, F.R.S., F.G.S., &c., I cannot sufficiently repay with a "Thank you very much."

That I have availed myself somewhat largely of the golden opportunity thus happily presented to me, in Chapters 8 and 9, I candidly admit; but I have done so under the influence of several motives, the principal of which are (1) an ardent desire to promulgate the Gospel of Nature, combined with a Zoologist's respect for the learned, accurate research, and masterly conchological knowledge

displayed in his always-reliable, deeply-interesting, and highly-instructive volumes; and (2) a consciousness of the inadequacy of my own zoological observations and conchological knowledge in comparison with that of the justly-esteemed author in question, to *thoroughly* meet the requirements of the Naturalist, and (I hope) the appreciative pleasure of the general reader.

Possibly my close and faithful adherence to the text of the above-named writer may demand some slight apology from me, or, at least, an explanation of the reason for my verbatim quotations of his minute and scientifically-graphic description of the conchifera. In reply to that, I may plead that no apology is requisite; for, it being understood that this work is, professedly, a compilation, continuous and complete extracts from such a standard source surely do not need an apology. But, even granting this apparently questionable premise, the reader may urge that I should not have overstepped the modesty of a favour in avariciously extracting the bulk of a fat pamphlet, where (perhaps) only a few pages had been intended as an advantageous aid by the friend mentioned.

In answering this natural observation, I must emphatically impress upon the reader's mind the fact, that to have abridged Jeffreys' text would but have served to diminish its merits. His concise style is so favourably adapted to scientific literary composition, that it allows neither of addition, subtraction, division, or alteration, without entirely nullifying its characteristic construction, and illustrative or critical utility. To the Conchologist his observations and critical remarks, his various linguistical abilities and wide reading, greatly enhance the value of the work. To the general reader, although the scientific

nomenclature of shells (which for his benefit I have carefully translated) may be somewhat dry reading, there is a large amount of information throughout which cannot fail to be instructive. Apart, however, from the scientific portion of his "British Conchology," Jeffreys shows literary abilities of so high an order that one cannot but regret that his leisure moments were not spent in the composition of Essays, in which (great as his name is and will assuredly remain, for time to come, in Conchological Annals,) the bright star of his fame would have shone with equal, if not with more resplendency. But we must be thankful for what he has done. He has sojourned amongst us, and he has departed to another and a better world; and, in his Apprenticeship to Nature—toiling through a peaceful and happy lifetime as the MAN-APPOINTED REVEALER and EXPOUNDER of some of her wonderful mysteries—he proved himself one of the greatest Conchologists, if not *the* greatest that ever lived; and I need hardly add that the world of science—the Naturalist's world—the world in general, and far Posterity itself, will not willingly let his name sink in oblivion.

If, then, an apology be looked for from me, for lengthy quotation from the above-named standard author, let me make it in the words of Ruskin:—"I have always thought that more true force of persuasion might be obtained by rightly choosing and arranging what others have said, than by painfully saying it again in one's own way."—*Fors Clavigera*, 21, 14.

INTRODUCTION.

Of the millions who live to eat and eat to live, in this wide world of ours, how few there are who do not, at proper times and seasons, enjoy a good oyster. To the many, not only of the ignorant and stolid, but of the cultivated and intellectual, an oyster is simply a delicacy. The mere oyster-eater eagerly seizes that double-shell, thrusts his knife forcibly between its valves, gives it a hasty wrench, and extracting daintily the little creature within, instantly swallows it, without consideration. He may think, indeed, that if one oyster be agreeable, two or three dozen will be still more so ; and that there is, therefore, a large amount of pleasure accessible whenever the head is removed from a barrel of “ Milton ” or “ Colchester natives.” But all he does is just to gratify his palate, and to excite or to satisfy the cravings of his stomach. Now I am of opinion that an oyster, only regarded as a thing to be eaten, and having actually but a low place in the ascending series of animals, not only demands, but will richly reward, an enlightened examination.

It may not be an ungrateful task, therefore, if I endeavour to inform them what species of animals oysters are. In particular that little succulent shell-fish, that affords to man so much gastronomical enjoyment—how born and bred and nurtured ; when and where ; and, lastly,

how best it may be eaten, whether in its living and natural state, or having undergone the ordeal of cooking by the skill of a superior artist.

Certain of general sympathy, I have poured upon it all the learning I possess upon the subject ; all the taste I am capable of embellishing it with, and all my gastronomical experience on this delicious mollusc. In every page I have endeavoured (as it were) to chant in an undertone :

“Breathes there the man, with soul so dead,
Who never to himself hath said,
This is my own, my *Native* ?”

Both to the man of science and to the general reader, I have sought to make these pages, altogether, a pleasant mixture of eating and cooking, and digesting, and zoology, and ancient classics, and modern pleasant supper parties ; I have sought to make the apotheosis of the oyster become almost an epic theme ; and finally (as I have asserted in good faith so) I have sought to prove that, with respect to the oyster, it is good for the unborn child ; good for the child when two years of age ; good for adolescent youth ; good for manhood in its maturity ; and it is not only good, but a strengthener to old age in its inevitable decay. It can make the sick well, render the healthy stouter, prolong the shortening days of senility, and impart an additional charm to youth and beauty.

In offering, therefore, the Biography of an Oyster, I say with George Wither, when he presented his book to his sovereign :—

“Good Sir! reject it not, although it bring
Appearances of some fantastic thing
At first unfolding ;”

while the “caveat” of good Thomas Adams may well be

added: "Do not open it at adventures, and by reading the broken pieces of two or three lines judge it; but read it through, and then I ask no pardon if thou dislikest it. Farewell."



CHAPTER I.

ZOOLOGICAL REMARKS.

“ Each shell, each crawling insect, holds a rank
Important in the plan of Him who fram’d
This scale of beings ; holds a rank, which lost,
Would break the chain, and leave behind a gap
Which Nature’s self would rue.”

“ THINK you that a drop of water, which to the vulgar eye is but a drop of water, loses anything in the eye of the physicist, who knows that its elements are held together by a force which, if suddenly liberated, would produce a flash of lightning ? Think you that what is carelessly looked upon by the uninitiated as a mere snow-flake does not suggest higher associations to one who has seen through a microscope the wondrously varied and elegant forms of snow crystals ? Think you that the rounded rock, marked with parallel scratches, calls up as much poetry in an ignorant mind as in the mind of a geologist, who knows that on this rock a glacier slid a million years ago ?

The truth is, that those who have never entered upon scientific pursuits are blind to most of the poetry by which they are surrounded. Whoever has not in youth collected

plants and insects knows not half the halo of interest which lanes and hedgerows can assume. Whoever has not sought for fossils has little idea of the poetical associations that surround the places where embedded treasures were found. Whoever at the sea-side has not had a microscope and aquarium have yet to learn what the highest pleasures of the sea-side are."

HERBERT SPENCER.

WERE I to choose a supplementary title, I should call this work a Zoological Gleaner, wherein the Nineteenth Century culture—the literary culture which, according to Matthew Arnold, acquaints itself with "the best that is thought and known in the world" and the scientific culture which, according to Mr. Huxley, is simply "common sense at its best"—receives the full measure of the poetic interest which lies in common things.

Apart from the love for my subject which has impelled, upheld, and encouraged me to proceed in my self-imposed task; apart from the aim to clothe it in "the best that is thought and known in the world" relative thereto, I have ever had in view the aspiring ambition to make this work readable by all, and at the same time useful to my brother naturalists. Nor have I neglected the advice of Horace:

"Omne tulit punctum, qui miscuit utile dulci
Lectorem delectando pariterque monendo."

In allusion to which says the late distinguished naturalist, John Gwyn Jeffreys: (a)

(a) "British Conchology," Introduction, vol. ii.

“All that relates to Nature is in itself so delightful, and the pursuit of it elicits so many of our best and truest feelings, that every undertaking of this kind ought to be imbued with the sentiment inculcated by the above maxim, instead of repelling students by too much technicality.

“The author and his readers have a joint property in the subject-matter, and they are held together by the same tie of sympathy.

‘ . . . Pleasure is spread through the earth
In stray gifts to be claimed by whoever shall find.’

“Our communion with GOD, through His works, affords one of the purest and most unalloyed of pleasures that is permitted to us in this transitory state. Even the mere contemplation of them, in any of their various aspects, if it is made in a fitting mood, assures us, much more forcibly than human teaching can, that our minds—our spirits—our souls partake of His eternity, and are imperishable. This idea has pervaded all men and in every age. It is innate and ineradicable.

“At the same time it cannot be denied that novels, magazines, and newspapers constitute now-a-days the literature which chiefly occupies the small reading-time of the public, and that scientific books generally are overlooked, unless they advance some startling proposition as to the origin or remote antiquity of our own race. There can be no use, however, in blaming the popular taste; nor would it be reasonable to expect that every one should follow a scientific path, if his inclinations do not lead him that way. The love of Nature is not confined to any one period, and its votaries must not feel disappointed, should their peculiar studies not be shared by all their contemporaries.”

The volume whence the latter paragraph of the above extract is taken, was published in 1863, and the reader will agree with me in saying that, had that able author lived at the present time he would have had no need to lament a scarcity of readers of works of science. In this extraordinarily advanced, and ever more and more rapidly advancing Scientific Age, it seems almost out of place to quote a paragraph of such tendency, but I have done so simply to show how wonderful has been the progress of Science even since 1863. To say nothing of the Zoological Works published since then, and those that are being published almost every week ; Zoology, in all its branches, is taught in our colleges and in many of our schools.

If, then, so happily resultant since the above period, or a decade or two earlier, would it not teach us a profitable lesson to look upon the other side also ? Assuredly so. Indeed, I think "The Trials and Triumphs of Zoology" would form a highly interesting volume, more enthralling than a sensational novel, because more truthful to Nature, and infinitely more instructive because Nature would be the Teacher : but I will not threaten my reader with the task of wading through such a voluminous history ; I will, simply, in the words of the translator of Milne Edwards' deservedly famous *Manual of Zoology*, give him a brief sketch of that branch of Natural History which has attained to such sublime place and glorious consummation among the Sciences, in the hope that it may serve a higher purpose than merely to interest him.

"Addressed to professional students (the *Manual*) and yet not exclusively so, who, partially educated, as the case may be, are about to qualify themselves for embarking in some one or other of the great professions which form the

occupation of the intellectual world, such studies seem uncalled for as barren of future profitable results. That such a feeling prevails with most professional students—using the term professional in its widest acceptation—I am well aware; indeed, as regards the students of one of these learned professions, none can know better, if so well, as I do. The Medical Director of the anatomical studies of many thousands of medical students, I have ever found them adverse to Science, strictly so called; especially to that branch of Zoological Science termed Natural History. They desire to be practical. Zoology is not a practical art: in this view, therefore, it leads to nothing.

“John Hunter had lived and laboured; his vast ideas, his brilliant discoveries, his views, which seem more like inspirations than the natural result of an industry unsurpassed, lay buried in the hall of a corporate body with whom, as a surgeon, he was accidentally associated; but he had laboured in vain. His views he placed before the world in the form of a museum, to which none of the labours of men’s hands can be compared—unless it be, and these no doubt excel, the handiwork of those who carved the Medicean Venus and the Belvidere Apollo. Yet he had laboured in vain, for never, I believe, at any period of its history, was Zoology in a lower condition in Britain than that in which I found it when, returning from France in the summer of 1825, I submitted to a small but select class an outline of those great views which France and Germany had taught me, and which I have continued to meditate and reflect on to the present day. Since that period the educational institutions of the country have become somewhat multiplied, perhaps improved. The pressure of continental opinion has told on Britain, and ere long it is by no means improbable the sciences of simple

observation may be deemed, if not equal in importance to those great branches of human knowledge wrapped up in the study of numbers and of literature, at least useful, practically calculated to expand the intellect—the first object of all education.

“It is a matter not only curious in itself, but fraught with interest to the future historian, to trace, however briefly, the gradual unfolding of modern education, as contrasted not merely with the ancient but with that which, even in my younger days, prevailed everywhere. The interest lies chiefly in contrasting the low estimate which prevailed respecting the nature and character of the sciences of simple observation as compared with true science; that description of knowledge which admits of *a priori* reasoning, from that which scarcely, if at all, admits of such. Hence, no doubt, the exclusion of chemistry, anatomy, and natural history, from the curriculum of all Universities, Schools, Colleges, Examining Bodies.

But of one thing I am thoroughly convinced. This improved condition of education, even in France, was the result of accident—of the accidental appearance in France of a man destined to revolutionize all Zoological Science, viewed under every possible aspect—that man was George Cuvier. To be convinced of the truth of this view, we have but rapidly to trace the history of Zoology from the period of the immortal *Historia Animalium* of Aristotle to that of St. Pierre and Faujas St. Fond. (*b*.)

“Before Rome existed, and before the *Iliad* was composed, Egypt had its Pyramids and its Thebes; that land (*b*) See “Great Artists and Great Anatomists.” London: Van Voorst.

of practical science bordered on regions of the earth surpassed by none for variety in the forms of animal life. I allude to Africa within the tropics. Nearly every animal susceptible of domestication and useful to man had been appropriated by the Coptic race of Egypt and Nubia; whilst all the *wilde* of nature had in succession been exhibited to the nation in various triumphal processions. But all this was merely practical and transitory. It was the same with Rome, Eastern and Western; no science resulted from it, no Zoological Science, at least; and the dawn of civilization which re-opened in Europe after the dreadful period of the Dark and Middle Ages, found Zoological and Natural Science precisely where it was left by Pliny—a tissue of puerilities, of vague hypotheses, of silly fancies, upon which no critique had ever been exercised.

“Notwithstanding the occasional appearance of able men, it continued in this sad state until the close of the seventeenth century. Neither Zoology nor Mineralogy nor Geology had any real existence.

“In 1707, or about that period, two men appeared, simultaneously, destined to rescue Zoology at last from the degraded state to which Pliny and his imitators, abounding most in England, had reduced it. These were Carl Linné and the Count de Buffon. To these truly great men we owe the first attempt to remove the Natural Sciences from the control of those into whose hands they had fallen. The genius of Linné led to classification, that of Buffon to description; the one defined, the other described. But the genius of the latter was of a higher cast: it anticipated the future; and men now read with surprise and learn with astonishment (a surprise and astonishment in which I do

not partake) (c) that Buffon was no mere compiler, no mere literary man, no mere writer destined to captivate the world by the beauties of a style unmatched, I believe, in France, but a profound philosopher who had already anticipated nearly all the great truths of the transcendental in Science. But neither Buffon nor Linné, whatever might have been the profundity of their views, offered any demonstration of these views. This is what the world looks for, and rightly expects; rigid demonstration supported the Newtonian hypothesis, else Newton had written in vain. Palissy, the potter, had said as much as Buffon, but, like him, he had offered no demonstration, and the world looked on them as dreamers—dangerous dreamers, of whom the less notice that was taken the better. In Britain, especially, Buffon's works appeared stripped of all their lofty views, disfigured and degraded; he passed, even in France, merely as the naturalist who had best described the hot-blooded quadrupeds, as certain mammals were called even in my days; the bold conjectures of Palissy and of Buffon seemed about to disappear for ever from the field of science. Even Goethe had failed to resuscitate them under other forms. The geological theories of Hutton and Playfair were met successfully by the plausible hypothesis of Werner, when suddenly a man appeared, destined to place Natural Science for ever on a basis which, if not so fixed as the *Elements* of Euclid, will at least prove as enduring. That man was George Cuvier, a German, born on French soil; an anatomist. This wonderful man, of a rigidly demonstrative turn of mind, when quite young, bethought him of investigating 'the unknown' in Zoology by means of anatomical research, the only way in which it could be inquired into. Linné and Buffon had described

and defined the exterior: 'I will investigate,' he said, 'the interior': they ought to correspond: there must be intimate relations between them: anatomical co-relations. Seemingly, and without being aware of it, he had discovered a new element of research—descriptive anatomy; not the vague comparative anatomy of Perrault or Daubenton, but minute descriptive anatomy worthy of Hunter and of himself.

"Yet he was very young, and knew nothing of Hunter and but little of Daubenton. Genius directed his steps, that genius which, when it appears, and happily escapes the crushing influences 'of established socialisms' is sure to form a new era. Like most of the great men of his day (products of the French Revolution) he had outstripped in his merest youth the age he lived in, and rapidly shot beyond that which was to follow.

"Cuvier's early pursuits were the rectification, by means of anatomy, of the classifications of Buffon and Linné; but he quickly, as it were instinctively, passed beyond this comparatively narrow field into one which has no limits. Whilst pursuing his enquiries on the structure of the invertebrate kingdom, he soon saw that the animal forms he dissected differed specifically and generically from those fossil forms which lay around him. Palissy, the potter, had seen the same; Buffon had announced the fact: they were declared to be dreamers. Cuvier offered to mankind the *Ossemens Fossiles* in proof that they were so, and from that moment to the present day few have had the hardihood to deny the proof: none but those who regard the Newtonian demonstration as an idle unprofitable dream.

"The importance thus given to Zoological studies and pursuits by the application of the anatomical method in

Zoology, would have commenced and terminated with Cuvier but for this one circumstance—he had created Geology, Palaeontology; that last and most wonderful science, which seems to have no limits. He had shown that without a knowledge of the extinct Zoologies there can be no Geology, properly speaking: none at least likely to interest man. Now this extinct Zoology cannot be well understood, if at all, without a knowledge of the living Zoology, that being the term and mean of comparison. Thus was Zoology forced at last into the Schools, Universities, and Collegiate Institutions (*d.*)

“The necessity for this was first seen and admitted in France, from whence it naturally was imported into England, where Cuvier and his supposed views had become fashionable; the single geologist at the Board of Ordnance, McCulloch, was slowly replaced by a body of scientific men, each teaching a different department of Natural Science; out of this arose a School of Practical Geology, and various chairs in a similar direction came to be founded in Collegiate Educational Institutions. The illustrious Sedgwick, to whom Geology unquestionably owes its present position in Britain, set an example in Cambridge which cannot be too much praised nor too closely followed.

“Thus originated, the gradual introduction of zoological science into the curriculum of study for university honours demanded of all, I presume, who mean to follow

(*d.*) Cuvier had shown Anatomy to be the only safe basis for testing Zoology, and a comparison of it with the extinct the only guide to Palaeontology; it may be, and has been, called an empirical method, by which I presume is meant that the method is not strictly scientific. I have all my life been of this opinion, but the method notwithstanding has led to results second only, if second, to the Newtonian discoveries.
—Translator's Note.

out a professional vocation in France: England slowly follows."

Such is a hasty sketch of the state of Zoological Science at the beginning of the present century. I need not trouble the reader either with account or description of the mighty seven-league strides we have made since then, not only in Zoology, but in the practical Arts and Sciences generally; nor need I remind him that, in many respects, our progress has been and is so astonishing that the mind becomes bewildered in the contemplation of the possible achievements of Science in the future; but, in connection with the subject of this chapter, let us, by the descriptive aid of an able author, glance for a moment at the backwardness of the past century in contrast with the advancement of the present.

"One of the differences between the eighteenth century culture and the culture of the nineteenth century is the advantage which the latter has of being able to see more deeply into the poetry of common things. And by this we do not mean that sentimental reflectiveness over daisies, primroses, dandelions, and peasant children, which Wordsworth found necessary to employ in his endeavours to bring us back to Nature, nor that the eighteenth century was without its interpreters of this kind of poetry. For the eighteenth century had a Cowper, who saw deeply into the poetry of common things, and there were certain Essayists then also who could preserve for us the very atmosphere in which a simple country gentleman, Sir Roger de Coverley by name, moved and displayed his little peculiarities. But in saying that the culture of the nineteenth century has the advantage of being able to see more deeply into the poetry of common things than the culture of the

eighteenth, we merely mean that science has so widened the bounds of knowledge about common things, and deepened the interest in them, that the ordinary all-round culture of to-day, even when not particularly or very consciously poetical in its spirit, is more deeply imbued with the poetry of common things than the best culture of the eighteenth century. . . . It was not given to the man of culture in the eighteenth century to know the thousandth part of the interest which lies in the commonest objects—a drop of water, a snow-flake, a glacier, rounded rock, a fossil, a plant, or an insect.

‘A primrose by a river’s brim,

A simple primrose was to him.’

And it may have been this much more than by the power of memory and association it suggested thoughts which were denied, perhaps, to the next observer. But to the man of all-round culture to-day—the man of insight as well as knowledge—in the commonest weed or clump of moss there lies a mine of historical and poetical wealth. And to the study of the commonest objects what guidance he has! A Kingsley to teach him the way to study the pebbles of the street, the slates of the roof, and the coal in the mine; a Darwin to show how the earth-worm has contributed to agriculture; a Faraday to make the common candle shine more wonderfully than the genii’s lamp; a Lubbock, to observe the ways of the ant; and a Huxley, to surround the cray-fish with the deepest intellectual interest. And to the list of science popularisers may we not add the Canadian names of Sir William Dawson and Grant Allen?

“But if the nineteenth century has these advantages, it must be remembered that only culture—the literary culture

which, according to Matthew Arnold, acquaints itself with 'the best that is thought and known in the world,' and the scientific culture which, according to Professor Huxley, is simply 'common sense at its best'—receives the full measure of the poetic interest which lies in common things. The man of science only, who is satisfied with merely dissecting and classifying a flower, misses as much as the man of sentiment only, to whom a flower may or may not suggest thoughts through memory or association.

"Perhaps one of the best examples we have of the happy combination of literary with scientific culture—where literature has been studied for its own sake, and where science has been studied for its own sake—is to be found in the philological works of Max Müller. Max Müller has studied words in much the same way as Agassiz studied fish bones, or as Boyd Dawkins hunted English caves. He has analysed them and traced them to their roots 'dead from the waist down,' but by the power of literary culture, the power of knowing 'the best that is thought and known in the world,' he has been able to associate the barest skeletons of words with man's history—with his struggles, his development, his achievements, his hopes, his fears, and his religions."

In concluding this Chapter, it only remains for me to touch briefly upon the object and utility of Natural History.

Natural History is that science which treats of the structure of bodies spread over the surface of the globe, or forming its mass—the phenomena exhibited by these bodies, the characters by which they may be distinguished from each other, and the part they play in the entire creation. Its range is immense, and its importance is not

inferior to its extent. Some but little acquainted with science, see in natural history merely a collection of anecdotic facts, more calculated to excite the curiosity than to exercise the understanding; or a dry study of technical terms and arbitrary classifications. Such an opinion is based on ignorance: and the utility of the study of natural history cannot fail to be recognised by all who possess even the preliminary ideas of the science. The grand and harmonious view it presents of Nature, whose *beau ideal* is so much superior to that of human invention, tends to elevate the mind to lofty and sound thoughts.

The knowledge of ourselves and of surrounding objects, is not given merely to satisfy the desire for learning which develops itself always according as the intelligence enlarges; it forms a necessary basis to many other studies, and is eminently calculated to give to the judgment that rectitude in the absence of which the most brilliant qualities lose their value, and in the course of life lead the mind astray.

On the other hand, to be convinced of the practical importance of the natural sciences, we have only to look to geology and mineralogy, and the services they have rendered to industry; to botany, and to the myriads of beauteous and useful plants it describes; and to horticulture, of which it is the guide; to recollect the animals to which we owe wool, silk, honey—which lend us that power which man so often requires, or which, far from being useful to us, threaten our harvests with destruction; lastly, to consider the long catalogue of human infirmities, and to reflect on the dangerous character of that medicine which is not based on a scientific knowledge of the human structure.

But the utility of these sciences does not stop here ; in an educational point of view, their study accustoms the mind to proceed from effect to cause, testing each hypothesis by an appeal to facts. Finally, before all other studies, that of Natural History trains the mind to *method*, that part of logic without which all investigation is laborious, every exposition obscure. (*e*)

(*e*) "Manual of Zoology."—Milne Edwards.



CHAPTER II.

ANCIENT HISTORY OF THE OYSTER.

THE ANCIENTS—OYSTERS A GREEK AND ROMAN LUXURY—SERGIUS ORATA, AND THE OYSTER-BEDS OF BAÏE—IMMENSE CONSUMPTION AT ROME—FAILURE OF THE CIRCEAN AND LUCRINIAN OYSTER-BEDS UNDER DOMITIAN, AND INTRODUCTION OF RUTUPIANS FROM BRITAIN—AGRICOLA, CONSTANTINE, AND HELENA—ATHENIAN OYSTERS, AND ARISTIDES.

WHERE do we first find historical mention of oysters? Did the ancient Egyptian ever press between his teeth the dainty mollusc? Does the oyster figure on the monuments of that remarkable people? Although, as Sir G. Wilkinson tells us, the Egyptians were not contented with the abundance of fish afforded by the Nile, but constructed within their grounds spacious sluices or ponds for fish, like the vivaria of the Romans, where they fed them for the table, and where they amused themselves by angling and the dexterous use of the trident, it does not appear that they had any knowledge of ostreoculture, and it is doubtful whether these molluscs ever formed part of their food. "Of the division of the animal kingdom, the mollusca, containing shell-fish, nothing is known which connects any of them with the religion of Egypt." (*a*)

(*a*) "Ancient Egyptians," vol. 3, p. 53, and vol. 5, p. 125.

Though oysters and other conchiferous molluscs were not disallowed as food for the ancient Jews by any precise definition in the Levitical law, there can be no doubt that they would be regarded as “abominable things.”

M. Dabry de Thersant, in a number of the “China Review,” as quoted in the “Flight of the Lapwing,” states that artificial oyster-beds were formed in China long before they are known to have existed amongst the Romans, and, while in Europe essays and pamphlets are being written on the theory of the subject, the practical Chinese have been obtaining good results for the last 1800 years, notwithstanding the fact that they have no clear ideas as to the nature of the oyster or its means of reproduction.

It has been supposed that Homer alludes to oysters in the following lines, where Patroclus insults the charioteer of Hector, as he falls from his chariot:—“Ye gods, how active the man is, how gracefully he dives; if he were anywhere in the fish-producing sea, this fellow might satisfy many diving for oysters.”—*Il.* 16, 745-7.—But it is very doubtful whether the Greek word *tethea* denotes oysters; it occurs nowhere else in Homer, nor does the poet ever make use of the ordinary word for an oyster, namely, *ostreon* or *ostreion*. It is true that Athenæus says that the *télhos* and the *ostreon* are the same; but his assertion cannot be reconciled with other passages where the words occur. Thus Archestratus of Syracuse—no mean authority on everything that relates to fish—speaks of Abydos as the best place for *ostreia* and Chalcedon for *téthea*, in the very same book:—

“Aenus has mussels fine; Abydos too
Is famous for its oysters; Parium produces
Crabs, the bears of the sea, and Mitylene periwinkles.
Ambracia in all kinds of fish abounds,

And the boar-fish sends forth ; and in its narrow strait
 Messene cherishes the largest cockles.
 In Ephesus you shall catch chemae, which are not bad ;
 And Chalcedon will give you oysters." (b)

Aristotle has given us so precise a description of the *têthea* as to leave not a shadow of doubt that the tunicated molluscs, or *ascidia*, are denoted by the term.

Dr. Schliemann found oyster-shells in large numbers in the ruins of all the five pre-historic settlements at His-sarlik, showing that oysters must have been a favourite food with all the early settlers, and their abundance in the first and oldest city is confirmed by Professor R. Virchow. (c)

As the old Greeks ate sea-urchins, limpets, sea-anemones, balani, &c., we see no reason why they should not have swallowed tunicated molluscs : a species of this family is at present eaten in South America ; when boiled or roasted it is said to taste like lobster.

Aristotle was well acquainted with oysters, but nowhere lets us know whether he was ever in the habit of tickling his philosophic throat with the dainty morsels. He uses the term *ostrea*, sometimes to denote conchiferous molluscs generally, at other times oysters proper. In the concluding chapters of the *Timæus*, in which Plato inculcates the Pythagorean doctrine of the transmigration of souls, after having disposed of the probable future estate of those men who have lived effeminately—they were to be changed into women—and those who have passed their time frivolously—they were to be changed into birds—and those who had paid no attention to philosophy—they were to be turned

(b) Athenæus "Deipnosophists," vol. I, bk. 3, p. 154.

(c) "Troja," by Dr. Henry Schliemann, see note 6, p. 285.

into beasts—assigns the state of fishes and oysters and other aquatic creatures to those people who were thoroughly ignorant and without thought. In the *Phaedrus* (*d*) he speaks of the soul being fettered to the body like an oyster to its shell. (*e*)

The Greeks have not said much in praise of oysters; but then they knew nothing of Britain beyond its name, and looked upon it in very much the same light as we now regard the regions of the Esquimaux; and as to the little dabs of watery pulp found in the Mediterranean, what are they but oysters in name? Indeed, the best use the Athenians could make of them was to use their shells to ostracise any good citizen who, like Aristides, was too virtuous for a “Greek.” However, on the plea that oysters are oysters, we presume—for it could not be on account of their flavour—“oysters,” says the author of the “*Tabella Cibaria*,” “were held in great esteem by the Athenians.” No doubt, when Constantine moved the seat of the Empire from Rome to Constantinople, he did not forget to have his Rutupians regularly forwarded; so, perhaps, after all, it was our “Natives” which thus found their way into Greece, that they delighted in; and if so, the good taste of the Athenians need not be called into question; but, as in literature and the arts, in oyster-eating too, it deserves to be held up to commendation. (*f*).

There were other places from whence oysters were procured, and Mucianus speaks with rapture of those found at Cyzicus, a town in Asia Minor, on the shores of the Sea of Marmora, the ruins now called by the Turks, Bal Kiz. He describes them as larger than those of Lake

(*d*) *Phaedrus*, 30 c.

(*e*) “*Edinburgh Review*,” 1868.

(*f*) “*The Oyster*.”

Lucrinus; fresher than those of the British coasts; sweeter than those of Medulae (the district in the vicinity of Bordeaux, now called Medoc); more tasty than those of Ephesus; more plump than those of Lucus; less slimy than those of Coryphas (a town of Mysia, opposite Lesbos); more delicate than those of Istria, and whiter than those of Circeii (a town of Latium). But, on the question of the best kinds, Pliny does not agree with Mucianus, though so high an authority—for the latter appears to have been a sort of Frank Buckland in his day, as an authority on oysters.

“Notwithstanding this opinion,” he says, “it is quite certain that no oysters can compare with those of Circeii in point of sweetness and delicacy of flavour.”

The Romans, it is clear, paid considerable attention to the cultivation of oysters, and consumed vast quantities of them; and although there was some difference of opinion as to their wholesomeness as food, on the whole Roman taste was decidedly in their favour. Horace, Martial, and Juvenal, Cicero and Seneca, Pliny, Aetius, and the old Greek doctor, Oribasius, whom Julian the Apostate delighted to honour, and other men of taste amongst the ancients, have enlarged upon the various qualities of the oyster; and was it not to Sergius Orata that we owe our present oyster-beds; for he it was who introduced layers or stews for oysters at Baiae, the Brighton of ancient Rome, as we have them at present.

The author of that highly instructive and amusing brochure, “Silver-shell, or the Adventures of an Oyster,” in alluding to the above, thus describes the birthplace of European oyster culture:—

“Naples owes its fame, and probably its existence, to the superlative loveliness of its situation.”

“ Not a grove,
Citron, or pine, or cedar ; not a grot,
Sea-worn and mantled with the gadding vine,
But breathes enchantment.”

So says Rogers. But, assuredly, in no spot on earth are the skies brighter, or the waters more pellucid and serene.

In the wide and sunny expanse of blue waters that stands near this far-famed city, no part was calmer or more beautiful than the recess in the northern part of its bay, between *Baiae* and *Puteoli*. Naturally sheltered by the surrounding coasts, it seemed of itself to invite the gratification of luxurious ease, and the formation of a mercantile harbour. *Baiae* was resorted to by the Romans, as *Brighton* and *Cheltenham* have been in our times, by invalids and the restless in fashionable life ; while *Puteoli*, on the opposite side of this inner bay, was, on a small scale, what *Liverpool* is to *England*. Between them was an enclosed reach of water, called the *Lucrine Lake*, over which coloured sails wafted the small yachts of fashionable visitors, and which contained the oyster-beds for the luxurious tables of *Rome*.

Martial says, in one of his epigrams:—

“ No praise, no price, a gilt head e’er will take
Unfed with oysters of the *Lucrine Lake* ;”

for those were greatly preferred which, being brought from other places, were deposited in these waters, where they grew remarkably fat. The oysters were then most highly esteemed which had the edges of the mouth of a deep brown hue, and, indeed, almost black. To these they gave a special name—it is said to have been *calliblephara* ; but the term is supposed to have become corrupted.

That was in the days when luxury was rampant, and when men of great wealth, like *Licinius Crassus*, the levia-

than slave merchant, rose to the highest honours ; for this dealer in human flesh, in the boasted land of liberty, served the office of consul along with Pompey the Great, and on one occasion required no less than 10,000 tables to accommodate all his guests. How many barrels of oysters were eaten at that celebrated dinner, the “Ephemerides”—as Plutarch calls “The Times” and “Morning Post” of that day—have omitted to state ; but as oysters then took the place that turtle-soup now does at our great City feeds, imagination may busy itself if it likes with the calculation. All we know is, that oysters then fetched very long prices at Rome, as the author of the “Tabella Cibaria” has not failed to tell us ; and then, as now, the high price of any luxury of the table was sure to make a liberal supply of it necessary, when a man like Crassus entertained half the city as his guests, to rivet his popularity.

But the Romans had a weakness for the “breedy creatures,” as Christopher North calls them in his inimitable “Noctes.” In the time of Nero, some 124 years later, the consumption of oysters in the “Imperial City” was nearly as great as it now is in the “World’s Metropolis ;” and there is a statement, which I recollect to have read somewhere, that during the reign of Domitian, the last of the twelve Cæsars, a greater number of millions of bushels were annually consumed at Rome than I should care to swear to.

These oysters, however, were but Mediterranean produce—the small fry of Circeii, and the smaller Lucrinians ; and this unreasonable demand upon them quite exhausted the beds in that great fly-catcher’s reign ; and it was not till under the wise administration of Agricola in Britain, when the Romans got their far-famed Rutupians from the shores of Kent, from Richborough and the

Reculvers—the *Rutupi Portus* of the “Itinerary,” of which the *Regulbium*, near Whitstable, in the mouth of the Thames, was the northern boundary—that Juvenal praised them as he does; and he was right, for in the whole world there are no oysters like them; and of all the “breedy creatures” that glide, or have ever glided down the throats of the human race, our “Natives” are probably the most delectable. Can we wonder, then, when Macrobius tells us that the Roman pontiffs in the fourth century never failed to have these Rutupians at table, particularly, feeling sure that Constantine the Great, and his mother, the pious Helena, must have carried their British taste with them to Rome at that period. (*g*)

Pliny mentions that, according to the historians of Alexander’s expedition, oysters were found in the Indian Sea a foot in diameter, and Sir James E. Tennent unexpectedly attested the correctness of this statement, as at Kottiar, near Trincomalee, enormous specimens of the edible oysters were brought to the rest-house. One shell measured more than eleven inches in length, by half as many broad.

But this extraordinary measurement is beaten by the oysters of Port Lincoln, in South Australia, which are indeed the biggest edible oysters in the world. They are as large as a dinner plate, and the same shape. They are sometimes more than a foot across the shell, and the oyster fits his shell so well that he does not leave much margin. It is a new sensation, when a friend asks you to lunch at Adelaide, to have one oyster set before you fried in butter, or eggs and bread-crumbs. But it is a very pleasant sensation, for the flavour and delicacy of the Port Lincoln mammoths are proverbial in that land of luxuries.

(*g*) “The Oyster.”

Dr. Baster, as quoted by Dr. Johnston, appears to have been of opinion that the Roman predilection for oysters was a sanitary one. "Living oysters," he says, "are endowed with the proper medicinal virtues; they nourish wonderfully, and solicit rest; for he who sups on oysters is wont on that night to sleep placidly; and to the valetudinary afflicted with a weak stomach, oppressed with phlegm or bile, eight, ten, or twelve raw oysters in a morning, or one hour before dinner, are more healing than any drug or mixture that the apothecary can compound." This mode of acquiring an appetite for dinner appears to be continued to the present time, as it is not by any means uncommon, in a hospitable friend's house, to be asked to take a few oysters before dinner to give you an appetite.

Sallust, B.C. 50, appears to have had a very low estimate of our ancestors, or else a very high one of the oyster, when he says, "The poor Britons—there is some good in them after all—they produce an oyster."

Pliny has given us some valuable information on the subject of oysters, from which it appears that the modern system of oyster-culture was pursued by the old Romans, even as early as the time of L. Crassus, the orator. His remarks are worth transcribing;—

"The first person who formed artificial oyster-beds (*ostrearum vivaria*) was Sergius Orata, who established them at Baiæ, in the time of L. Crassus, the orator, just before the Marsic war (circ. B.C. 95.) (*h*) This was done

(*h*) "Not far from these oyster-beds rose a palace, in which the wealthy Roman used to assemble his choicest friends, and feast with them the whole day and night. Oysters occupied the place of honour on the table of Sergius Orata; at every feast thousands of them were consumed. Satiated, but not yet satisfied, these gourmets were in the habit of adjourning into an adjoining room, where they relieved the

by him, not for the gratification of gluttony, but of avarice, as he contrived to make a large income by the exercise of his ingenuity. He was the first, too, to invent hanging baths, and after buying villas and trimming them up, he would every now and then sell them again.

He, too, was the first to adjudge the pre-eminence, for delicacy of flavour, to the oysters of Lake Lucrinus; for every kind of aquatic animal is superior in one place to what it is in another. Thus, for instance, the best wolf-fish of the Tiber is caught between the two bridges, and the turbot of Ravenna is the most esteemed, the *muræna* of Sicily, the elops of Rhodes; the same, too, as to the other kinds, not to go through all the items of the culinary catalogue.

The British shores had not as yet sent their supplies at the time when Orata thus ennobled the Lucrine oysters; at a later period, however, it was thought worth while to fetch oysters all the way from Brundisium, at the very extremity of Italy; and in order that there might exist no rivalry between the two flavours, a plan had been recently hit upon of feeding the oysters of Brundisium in Lake Lucrinus, famished as they must naturally have been after so long a journey." (i)

We have here an early notice of people gathering oysters from one locality and transplanting them to other stomach of its load by artificial means, and then returned to indulge again their appetite with a fresh supply of oysters. Strange as it may appear to us in the nineteenth century, this custom was universal amongst the wealthy of Imperial Rome, Cæsar himself often indulging in it, when the repast was to his taste; and ladies, the cream of the cream of that luxurious period, carried about with them peacock's feathers and other dainty throat ticklers for the purpose, when they anticipated a more luxurious feed than usual."—"The Oyster," p. 40.

(i) Nat. Hist., vol. 6, p. 469, ed. Bohn.

feeding grounds. Sergius Orata's name must descend to posterity in connection with a very important and lucrative trade. He was a successful cultivator of oysters, and could always supply them to the Roman epicure from his own parcs. Let the storms blow as they list, and the waves of the sea beat against the coast, Sergius Orata can always provide the oyster-eater with the dainties he loves so much. (j).

But although in Orata's days no legislative enactments were in force forbidding the removal or sale of the molluscs, yet it appears the course of oyster-rearing did not always run smooth, for a certain Considius thought that Orata was encroaching too much upon public property in the buildings he had erected upon the Lucrine Lake, and the great oyster-cultivator had to go to law in the matter. What were the particular points touched upon by the plaintiff, and what the defence on the other side, history does not inform us ; but L. Crassus, the celebrated special pleader, whose oratorical powers might possibly have been aided by a preliminary enjoyment of a score of Lucrine natives, was the defendant's counsel. All we know is, that he assured his excellent friend Considius that he had made a great mistake if he supposed Orata's removal from the

(j) "*Ne gulum Neptuni arbitrio subjectam haberet, peculiaria sibi maria excogitavit, æstuariis intercipiendo fluctus, pisciumque diversos greges separatos molibus includendo, ut nulla tam saeva tempestas incideret, qua non Oratae mensae varietate ferculorum abundarent. Ædificiis etiam spatiosis et excelsis deserta ad id tempus ora Lucrini lacus pressit, quo recentiore usu conchyliorum frueretur. Ubi dum se publicæ aquæ cupidius immergit, cum Considio publicano iudicium nactus est. In quo L. Crassus, adversus illum causam agens, errare suum Considium, dixit, quod putaret Oratam, remotum a lacu, cariturum ostreis ; namque ea, si inde petere non licuisset, in tegulis reperturum.*" (Valerius Maximus, 9, 1, § 1.)

lake would prevent him rearing oysters, for if not allowed to cultivate them there, he would grow them upon the roof of his house. (*k*)

M. Coste (*l*) informs us that two antique vases have been discovered in Italy, upon which vivaria are depicted :

"These monuments," he says, "consist of two glass funereal vases. Their form is that of an antique bottle, wide in the body and long in the neck. Their exterior surface is covered with perspective designs in which, in spite of the clumsy drawing, we can recognize vivaria contiguous to certain edifices and communicating with the sea by arcades. And were it possible to have any doubts as to their situation and topographical position, these would be dissipated by the accompanying inscription. We read on the base of one of them STAGNUM PALATIUM (a name formerly borne by the villa possessed by Nero on the shores of the Lucrine) and lower down OSTREARIA. The other vase, which had been preserved in the Borgiano Museum at Rome, and now in the Propaganda, of which M. G. B. de' Rossi has given an excellent description, bears the following inscription written above the objects figured, STAGNUM NERONIS, OSTREARIA. STAGNUM, SYLVIA, BAIÆ, which plainly shows that the prospect represented has been drawn from buildings and places on the famous shore of Baia and Pozzuoli."

M. Coste has given an engraving of these vases in his valuable work. But although to Sergius Orata is evidently due the merit of having first established oyster-parcs amongst the Romans, it appears from the fragments of Agatharchides (circ. B.C. 140) preserved by Photius (*m*)

(*k*) "Edinburgh Review," 1868.

(*l*) "Voyage d' Exploration," p. 98.

(*m*) "Photii Bibliotheca," c. 13, p. 1354, ed. Hoerschellius, 1653.

that the Æthiopians were not altogether ignorant of the art, for the Greek historian of Cnidus speaks of "the people wandering along the shores of the Arabian Gulf in search of shell-fish, which are found there of a size so vast as to be thought incredible by all who had not seen them. These they collect, and while as yet there is a plentiful supply of fish, put in stews, where they fatten them on newly gathered sea-weed and the heads of minute fish, so as to be ready for food in times of scarcity. What the giant molluscs are does not appear; but the passage is interesting as showing the early practice of fattening shell-fish in vivaria.

Pliny has written much about oysters, and the information he gives is curious. He says that for a long time past the palm has been awarded to them at our tables as a most exquisite dish. We are told they love fresh water, and spots where numerous rivers discharge themselves into the sea: hence it is that the *pelagia* (or deep-sea oysters) are of such small size and so few in number:—

"Still, however, we do find them breeding among rocks and in places far remote from the contact of fresh water, as in the neighbourhood of Grynium and of Myrina, for example. Generally speaking, they increase in size with the increase of the moon; but it is at the beginning of summer more particularly, and when the rays of the sun penetrate the shallow water, that they are swollen with an abundance of milk. . . . Oysters are of various colours; in Spain they are red, in Illyricum of a tawny hue, and at Circeii black both in meat and shell. But in every country those oysters are the most highly esteemed that are compact without being slimy from their secretions, and are remarkable more for their thickness than their

breadth. They should never be taken in either muddy or sandy spots, but from a firm, hard bottom; the meat should be short in fibre and not fleshy, nor overloaded with fringe ('beard'), and should lie wholly in the cavity of the shell. Persons of experience in these matters add another characteristic; a fine purple thread should run round the beard, this being looked upon as a sign of superior quality. These they call by the name of 'calliblephara,' or oysters with beautiful eyebrows. Oysters are all the better for travelling and being removed to new waters. Thus the oysters of Brundisium, it is thought, when fed in the waters of Avernus, both retain their own native juices and acquire the flavour of those of Lake Lucrinus." (*n*)

British oysters were first brought to the notice of Roman gourmets in the time of Agrippa (A.D. 78). Having introduced among the inhabitants of these islands the civilization of Rome, Agrippa afterwards imported to Rome the oysters of Britain. The far-famed Rutupians were taken from the shores of Kent, in the neighbourhood of Richborough, and appear to have been thoroughly appreciated. Juvenal, satirizing the gastronomic excesses prevalent in his time, alludes to our "Natives" in these lines :—

" And in our days none understood so well
The science of good eating ; he could tell,
At the first relish, if his oysters fed
On the Rutupian or the Lucrine bed ;
And from a crab or lobster's colour name
The country, nay the district, whence it came."
(*Sat.* 4, 139.)

The ancients, like ourselves, were in the habit of taking a few oysters as a prelude to the dinner.

(*n*) Nat. Hist., book 32, cap. 21.

“Dromeas the parasite,” says Athenæus, “when some one asked him whether the banquets in the city or at Chalcis were the best, said that the prelude (prooimion) to the banquets at Chalcis was superior to the whole entertainment at the city—calling the multitude of oysters served up the prelude to the banquet.” (*o*)

When L. Cornelius Lentulus (circ. B.C. 50) was installed as Flamen of Mars by L. J. Cæsar the augur, he gave a most sumptuous repast to a number of guests in his house, which had been gorgeously decorated for the occasion. Macrobius, the grammarian, has given us the “bill of fare,” which, so far as we are able to translate the passage, was as follows:—“Before dinner: sea urchins, raw oysters *ad libitum*, pelorides, spondyli, the fish turdus, asparagus. Next course: fat fowls, oyster patties, pelorides, black and white balani. Next course: spondyli, glycymerides, sea anemones, beccaficos, &c., &c.” (*p*)

Oysters were no doubt in ancient times, as now, often eaten at supper. Juvenal speaks of the “Venus Ebria” supping on large oysters and strong Falernian wine;

“Who at deep midnight on fat oysters sups
And froths with unguents her Falernian cups.”

(*Sat.* 6, 300.)

Of all ancient devourers of oysters, Vitellius—“the beastly Vitellius,” as Gibbon calls him—appears to have been the greatest. That Emperor is said to have eaten oysters nearly all day long, and to have swallowed as many as a thousand at a sitting; and though there must be some exaggeration here, yet when we remember the disgusting habit practised by the Romans, and notably by Vitellius, of whose gormandising powers Suetonius writes, “Facile

(*o*) Deipnosoph, 4, 8.

(*p*) “Edinburgh Review,” 1868.

omnibus sufficiens vomitando consuetudine," it is easy to understand how vast numbers might have been consumed by one oyster-eater. The "dull, unrelenting Tiberius," "the furious Caligula," "the profligate and cruel Nero," were all probably consumers of oysters to a large amount. Tiberius, or, as he was sometimes jocularly called, "Biberius," from his drinking propensities, actually presented a person of the name of Asellius Sabinus with 200 sesterces for a dialogue, in which he represents a contest between mushrooms, beccaficos, oysters, and thrushes, as to which has the best claim to superiority.

"When the Emperor Trajan was in Parthia," as we are told by Athenæus, "at a distance of many days' journey from the sea, Apicius Cœlius," who must not be confounded with the writer of a book of cookery which bears his name, "sent him fresh oysters, which he had kept so by a clever contrivance of his own; real oysters, not like the sham anchovies which the cook of Nicomedes, King of the Bithynians, made in imitation of the real fish, and set before the King, when he expressed a wish for anchovies, he, too, at the time being a long way from the sea."

"This mode," says Mr. M. S. Lovell, in his valuable and interesting "Edible Mollusca," in allusion to Apicius' "clever contrivance," "may possibly have been the same as that which is practised in Italy at the present day, where, as Poli tells us, they are carried from Tarentum to Naples, in bags, tightly packed with snow, which not only by its coolness preserves them, but also, by preventing them from opening their bivalves, enables them to retain in the shells sufficient moisture to preserve their lives for a long period. (q)

(q) Poli, "Testacea Utriusque Siciliæ."

But the oyster had its detractors amongst the ancients, as well as amongst ourselves. Seneca—who so admirably praises the charms of poverty, yet left prodigious wealth behind him; Seneca, the wise and moderate, who ate several hundreds of them every week, thus launches forth against many good things, and the mud-fattened mollusc amongst the number:—"Dii boni, quantum hominem unus venter exercet! Quid? tu illos boletos, voluptarium venenum, nihil occulti operis judicas facere, etiamsi præsentanei non furant? Quid? tu illam æstivam nivem non putas callum jecinoribus obducere? Quid? illa ostrea, inertissimam carnem, cœno saginatam, nihil existimas limosæ gravitatis inferre?" (*r*)

In another letter he says that, after having listened to Attilus declaiming against vices and follies, he for ever renounced oysters and mushrooms, for such things cannot properly be called food, and are mere provocatives of the appetite, causing those who are already full to eat more, a thing no doubt very pleasant to gluttons, who like to stuff themselves with such food as very readily slips down and very readily returns.

Cicero did not hesitate to confess that he had a special predilection for oysters; but he adds, that he could renounce them without any difficulty; which, by the way, he might as well have told to the Marines, if they were in existence in his day, for all the credence this remark of his has gained from posterity.

We prefer Horace, who in every passage honestly makes known his love for oysters, and eats them himself with as much gusto as he extols them to others. Care-

fully, too, does he note down from whom he procured them, and the name of the famous gourmet who at the first bite was able to tell whether an oyster came from Circeii or the Lucrine Sea, or from any part of Natolia. The ancients, our teachers in all arts, but especially in æsthetics, did not bolt the oyster, but masticated it. With true Epicurean tact, they always extracted the full enjoyment out of the good things set before them. Not so we; most of us now bolt them; but this is a mistake, for the oyster has a much finer flavour, and is far more nourishing, when well masticated.

The Romans needed not even the use of their teeth to tell them from whence the oyster came; a mere look sufficed to distinguish it, as may be seen in the following lines ascribed to Lucilius:—

“When I but see the oyster’s shell, I look and recognize the river, marsh or mud, where it was raised.”

Nor was this so very difficult a matter, for the shell, no less than the animal itself, as has already been shown, exhibits the nature of the food upon which the oyster has fed. From the time that the preference was given to the British mollusc, thousands of slaves were employed on the shores of the Atlantic, in procuring the oysters, which in Rome were paid for by their weight in gold. The expenses were so great that the censors felt themselves obliged to interfere. Not content with getting their oysters from distant shores, they had means by which to preserve them for some time, in hot weather; for which purpose, as we see in the Pompeian model-house at the Crystal Palace, their domiciles were furnished with a receptacle for water; for with those famous epicures the water-vivary was an essential necessary for the preservation of living fish, and

all that was necessary was to substitute sea-water for fresh. (*s*)

Various ancient authors were of opinion that the moon had peculiar influence over oysters and other shell-fish. Thus Lucilius, in one of his fragments, says :—

“Luna alit ostrea, et implet echinos, muribu’ fibras
Et pecui addit.”

Similarly Manilius :—

“Si submersa fretis concharum et carcere clausa,
Ad Lunæ motum variant animalia corpus.”

Horace, too, was of the same opinion :—

“Lubrica nascentes implent conchyliis lunæ.” (*t*)

Nor did the idea prevail only with the poets ; Cicero accepted it as a well-ascertained fact. “Ostreis et conchyliis,” he says, “omnibus contingit, ut cum luna pariter crescant pariterque decrescant.” (*u*)

The following story is told of Aulus Gellius :—“The poet Annianus, on his Falerian estate, was wont to spend the time of vintage in a jovial and agreeable way, and he had invited me and several other friends to pass those days with him. When we were at supper there, a large quantity of oysters was brought from Rome ; but when they were set before us, they proved, though many, yet all poor and thin. The moon (remarked Annianus) is now in truth waning, and on that account the oyster, like other things, is lean and void of juice. We asked what other things waste when the moon is old ? Do you remember, said he, what Lucilius says :—‘Those very things which grow with the moon’s increase pine away as it wanes ; the

(*s*) “The Oyster.”

(*t*) Sat. 2, 4. See also Pliny, Nat. Hist. 2, cap. 41.

(*u*) De Div. 2, 14.

eyes of cats become fuller or smaller according to the changes of the moon.' But that is still more surprising which I have read in Plutarch, that the onion becomes green and flourishing as the moon wastes away, and dries up again as the moon increases; and this is the cause, say the Egyptian priests, why the Pelusians do not eat the onion; because it alone of all potherbs has its turns of diminishing and increasing contrary to those of the moon."

It is curious to observe that this folly about the moon's influence on oysters continued to form a part of the popular creed even as late as 1666; for in the "Philosophical Transactions" of that year travellers to India "are solicited to inquire whether the shell-fishes that are in these parts plump and in season at the full moon, and lean and out of season at the new, are found to have contrary constitutions in the East Indies;" to which the answer was returned, "I find it so here, by experience at Batavia in oysters and crabs."

Even at the present day the Tarentines declare that oysters are fattest during the full moon, and they are also fully persuaded that the moon-beams have a pernicious effect upon sea-fish; therefore they cover over fish taken by moonlight, lest they should decompose. (v)

The Romans, like ourselves, were in the habit of sending presents of oysters to their friends, who, it is probable, returned the compliment in the shape of a boar's head, fat ducks, or some other welcome produce of the farm. Ausonius wrote a very amusing letter to his friend Theon, who had sent him only thirty oysters as a present:

"Accepi, dilecte Theon, numerabile munus.

Verum quot fuerint, subjecta monosticha signant."

(v) "The Fisheries of the Adriatic," by G. S. Faber.

The oysters were fine, but so few, so very easily counted—they were just three times his ten fingers, or Gorgon's heads if you multiply them by ten, or

“ Twice fifteen and nothing more,
Bakers' dozens two, and four,
Twenty-two plus eight, and then
Two full scores, deducting ten.”

Martial ridicules Papilus for dining so niggardly himself, and yet making expensive presents to friends for the sake of ostentation. Oysters are enumerated amongst the dainties:—

“ For thyself if the tail of a pilchard thou broil,
And on festivals swill a bean soup without oil ;
Teat, boar, hare, champignons and oysters and mullet
Thou bestow'st—my poor Pap has nor palate nor gullet.”
(Epigram 7, 78.)

In another place he speaks of the dark beards of oysters,

“ Et ostreorum rapere lividos cirros ” (Ep. 7, 20),

as one of the dishes which the gluttonous Sanctra was fond of pilfering off the table.

Oyster-shells were used by the ancient Romans in medicine and as a cement ; cuttle-fish bones and oyster-shells finely reduced to powder to cure wounds and ulcers, eruptions on infants' skins, chilblains, and as tooth-powder. Palladius (*zw*) recommends a cement made of figs, pitch, and powdered oyster-shells for repairing baths.

(*zw*) De Re Rust I, 41.

CHAPTER III.

MODERN HISTORY OF THE OYSTER.

FALL OF THE RUTUPIAN SUPREMACY—LOUIS IV. AND WILLIAM OF NORMANDY—CONQUEST OF ENGLAND, AND REVIVAL OF OYSTER-EATING IN ENGLAND—WALLFLEET OYSTERS—ANCIENT CRIES OF LONDON—OYSTERS IN THE MIDDLE AGES. BISHOP SPRATT.—THE POET COWPER ON OYSTERS.

WITH the fall of the Roman Empire came also the fall of the Rutupian supremacy ; and even the Roman Britons, driven into Brittany and the mountains of Wales by their truculent Saxon persecutors, had to forego these luxuries of the table, unless, perhaps, Prince Arthur and his Knights may now and then have opened a bushel, when they were seated over their wine, in that free and easy circle which has become so celebrated as to have formed a literature of its own. (a)

Sharon Turner, in his "History of the Anglo-Saxons from the Earliest Period to the Norman Conquest," tells us that in the dialogues composed by Elfric to instruct the Anglo-Saxon youths in the Latin language, which are yet preserved to us in the MSS. in the Cotton Library, there

(a) The Oyster, &c.

is some curious information concerning the manners and trade of our ancestors. In one colloquy the fisherman is asked, "What do you take in the sea?" "Herrings and salmons, porpoises, sturgeons, *oysters* and crabs, mussels, winkles, cockles, flounders, plaice, lobsters, and such like."

Necklaces of oyster-shells, limpets, and other shells, strung together on fibre or sinews, have been and are found in early British and Saxon graves. (*b*)

From the fourth century, to which Macrobius brought us, to the reign of Louis IV., of France, the history of the oyster is a blank; but that king revived the taste for our favourite, and during his captivity in Normandy brought it again into request with his conqueror, Duke William; so, when the Normans invaded England under William the Conqueror—the descendant of that Duke William, little

(*b*) In Britton's "History of Dorset," mention is made of the finding of a small urn in a barrow in the parish of Lulworth, about two inches high, and one inch in diameter, neatly covered with the shell of a limpet; but it was quite empty.

Beads made from the columella of *Strombus gigas* are found in sepulchral remains in Tennessee, Kentucky, and Indiana. So we are told by Dr. Daniel Wilson, in his "Prehistoric Remains," while the author of "Flint Chips" tells us that the shells of the *Dentalium* made into beads, have been met with in tumuli in Ohio. And Mr. T. J. Pettigrew, F.R.S., author of "A History of Egyptian Mummies," states that in Egypt, on the mummies of children, necklaces of natural shells, or shells figured in gold, silver, precious stones, &c., are found—chiefly, according to Passalacqua, met with on those of young girls. Finally, as a further illustration of this custom of the ancients still in vogue amongst barbarous nations, Mr. V. Ball, in his "Jungle Life in India," informs us that the women of the Andaman Islands wear various ornaments, and the most extraordinary are the skulls of their defunct relatives festooned with strings of shells, which some of them carry suspended from their necks.

more than a century later—they were not long in finding out how much Kentish and Essex oysters were preferable to those of France. Since then the oyster has held its own against all comers, as one of the most welcome accessories to the table of rich and poor, and has been protected in its rights and immunities by various Acts of Parliament. (*c*)

Among the authors who have written upon the natural history of the oyster since printing was invented, I believe Gesner is the first. The title-page of his work, liber iv. “*Qui est de Piscium et Aquatiliū Animantium Natura*,” bears the following letters as a date *CIIO IO CIIII.*, and was printed at Frankfort; the other volume, “*De Avibus*,” is dated 1535. Rondeletius and Belon, both of whom are quoted, bear dates, the former 1558, and the latter 1555, supposing my copies to be the first editions. (*d*)

Gesner in his History of the Oyster, “*De (Ostreis, sive) Bivalviis testa duriore contectis, Belonius*,” gives the following as the mode in which oysters were treated by the Romans:—“*Nam quae a Brundusio in Lucrinum lacum transferebantur (quum Romana res magnitudinis atque luxuriae fastigium teneret) ut veluti dulcium aquarum gaudentes adventu pinguescerent, integrae cum testis divendebantur.*”

This practice of the Romans is precisely what is done on the best managed beds at the present day. Gesner also states, quoting from Galenus, that they generate healthy humours, and gives an account of those which were supposed to be species in that day.

(*c*) See Chapter 31, and Appendix G.

(*d*) “History of the Oyster,” by T. C. Eyton.

Aldrovand, in his voluminous work published in 1606, quotes the account of Sergius Orata from Pliny, and also an account of the luxury of Æsop's son in eating oysters. This author's account is altogether indeed very amusing.

Jonston, in his "*Historia Naturalis de Exsanguibus Aquaticis*," published in 1657, gives a wonderful story of the earth having subsided in the time of the war with Mithridates, when lakes and rivers appeared, some fresh and others salt, stocked with oysters and fish. He also gives an account of the manner in which the crab enters the shell of the oyster, by inserting a stone between the valves when open, and devouring the fish at leisure. The Pontifical suppers in ancient Rome appear to have begun with echini, or sea-eggs, and oysters.

Dacosta's work, "*Historia Naturalis Testaceorum Britanniae*," appears to have furnished matter for most of the modern works on the Oyster. He mentions, quoting from Jacob's "*History of Faversham*," that a company of free dredgers existed there in the time of Henry II. (1154), and that they paid for their right the sum of twenty-three shillings and fourpence annually to the crown;—that two annual Admiralty or Water Courts were held, for the fisheries and of the oyster-trade, which, he says, received generally about £3000 from the Dutch.

The same author states, "that from the mouths or entrances of Sandwich Bay and the adjoining coast, or Richborough and Reculver, oysters are got in great plenty, and are the most delicious that can be taken; but as the beds do not afford native oysters sufficient for the demand, large quantities of small ones, called 'brood,' are annually collected from different parts of the surrounding sea, even from the Land's End in Cornwall, from Scotland, and

from France, in order to increase, and be ameliorated of their saltness by the constant flow of fresh water from two great rivers, the Thames and the Medway. It must therefore be admitted that, although oysters are found round all the coast, yet those of the bay of the Roman Rutupiæ, or Richborough, may justly claim the preference of all others."

From Bishop Spratt's account of oysters, given in the "History of the Royal Society," republished in Latin by Dr. Lister in his "Hist. An. Angl.," copied from Dale's "History of Harwich," by Pennant, in his "British Zoology," and since by Professor Forbes, I shall only quote, to show that, probably from the beds having been over-fished since the Bishop's time, the oysters now spawn much later than they did formerly. This subject will be referred to again in the course of the work more fully.

The Bishop states, "*that in the month of May* oysters cast their spawn (which the dredgers call spat): it is like to a drop of a candle, and about the bigness of a half-penny. . . . 'Tis probably conjectured that the spat in twenty-four hours begins to have a shell. In the month of May the dredgers (by law of the Admiralty Court) have liberty to catch all manner of oysters. . . . The reason of the scarcity of oysters, and consequently of their dearness, is that they are bought up by the Dutch."

"The reason why a penalty is set upon any that shall destroy the cultch is, because they fear that if that be taken away the ouse will increase, and then muscles and cockles will breed there and destroy the oysters, they not having whereon to stick their spat. . . . The male oyster is black-sick, and the female white-sick."

Barbut, in his "Genera Vermium," published 1788, states that the oyster is a reputed hermaphrodite, and that the spawn which they cast in May adheres to rocks and other matters at the bottom.

The "Systema Naturæ" of Linnæus, published 1735, and going through many editions, being merely an arrangement or classification of the Animal Kingdom, does not give us any information. (*e*)

Quaint old Norden, who made the survey of Essex in 1594, writes thus:—"Some part of the sea-shore of Essex yealdeth the best oisters in England, which are called Walffletes Oisters: there is a great difference between theis oisters and them which lie vpon other shores, for theis oyster, that in London and ellswher carieth the name of Walfflete, is a little full oister with a varie greene fynn, and like unto others in quantite and qualite are none in this land."

This statement is confirmed in the "Antient Cryes of London," where we find the following:—

"We daily cryes about the streets may hear,
According to the season of the year;
Some Wellfleet oysters call, others do cry
Fine Shelsea cockles, or white mussels buy." (*f*)

Occasionally we catch a glimpse of the indulgences of our forefathers in these little delicacies, as we examine their ancient records. Thus, for example, Henry Machin, citizen and merchant taylor of London, keeps a diary, in which all the good things of which he partook seem to have secured a special record; of which the following is a curious instance:—

(*e*) "History of the Oyster," by Prof. T. C. Eyton.

(*f*) Kirby's "Wonderful Museum," vol. 2, p. 233.

“On the 30th July, 1557, himself, Master Dave Gyttons, Master Meynard, and Master Draper, and Master Smyth, Master Caldwell, and Master Asse and Gybes, and Master Fackington, and mony mo, did ett alff a bushell of owsters in Anchur-lane, at Master Smyth and Master Gyttons’ seller, a-pone hoghedes, and candyll lyght, and onyons, and red alle, and clarett alle, and muskadylle fre cope, at viii. in the mornyng.”

There is also a record extant of “the seruing in of the feast of the East India Comp^a., at Merchantailors’ Hall, 20 January, 1622 (23).” In this bill of fare of provision for “the upper table, 4 messe,” we discover “roast mutton with oysters,” in the first course; and in the second course, “boyled oysters,” “dicto broiled,” “oyster pie,” and “pickled oysters.” Then for “the 2 side tables, 14 messe, and 2 messe for the gallery;” “roast mutton with oysters,” “roast capon 2,” whereof 1 with oysters appears in the first course; and in the second “oyster pie” and “oysters pickled.” But, though the following arrangements are equally conspicuous, “The wayters, 7 messe,” “For the clerke and the beadle of the hall, 2 messe between them,” and “For the players, 3 messe,” to none of these inferior classes, though they were far from being stinted, is there the *bonne bouche* of a single oyster.

In the scene in the Garter Inn, Falstaff says:—

“I will not lend thee a penny.”

To which Pistol replies:—

“Why, then, the world’s mine oyster,
Which I with sword will open.”

And the opening of oysters was, at that period, doubtless of common occurrence. Women are now very rarely seen carrying oysters in tubs on their heads, or standing

at their side, to supply their customers ; yet, even half a century ago, they were numerous in the streets of the metropolis. In earlier times they formed a well-known class of the people, to whom many allusions will be found in the works of the most eminent writers.

When, for example, Aumerle is describing to Richard II. the insinuating conduct of "high Hereford," he says that he, Bushy, Bagot, and Green,

"Observed his courtship to the common people :—
How he did seem to dive into their hearts,
With humble and familiar courtesy ;
What reverence he did throw away on slaves,
Wooing poor craftsmen with the craft of smiles,
And patient under-bearing of his fortune,
As 'twere to banish their affects with him.
Off goes his bonnet to an *oyster wench* ;
A brace of draymen bid—God speed him well,
And had the tribute of his supple knee." (g)

Bishop Hall, when satirising an old country squire, who starves himself to make his son a lawyer and a gentleman, says :—

"Old drivelling Lolio drudges all he can
To make his eldest son a gentleman.
Who can despair to see another thrive
By loan of twelve-pence to an *oyster wife* ? "

And, not to multiply instances, Butler describes the time when—

"The oyster women locked their fish up,
And trudged away to cry, No bishop ! "

Numbers of persons, therefore, must have repaired to the tubs of these women—manifestly of a low class—from among the humbler ranks of the people, to refresh them—

(g) Richard II., Act I, Scene iv.

selves with a few, if their pockets forbade the gratification derivable from scores of these delicacies, in the court, the alley, or the street. (*h*)

Bishop Spratt, after attributing the scarcity of oysters to exportation to the Dutch, says:—"There are great penalties by the Admiralty Court laid upon those that fish out of those grounds which the Court appoints, or that destroy the cultch (the spat) or that take any oysters that are not of size, or that do not tread under their feet, or throw upon the shore, a fish which they call a five-finger, resembling a spur-rowel, because that fish gets into the oyster when they gape, and sucks them out."

Slow conveyances were for a long period formidable impediments to the enjoyment of oysters in the best condition by the higher classes, and it was thought a feat when such difficulties were surmounted. This appears in the statement of Dr. Fuller:—"I have heard that oysters put up with care, and carried in the cool, were weekly brought fresh and good to Althorp, the seat of Lord Spencer, which was eighty miles from the sea; and it is no wonder, for I myself have eaten, in Warwickshire, above eighty miles from London, oysters sent from that city, fresh and good; and they must have been carried some miles before they came there."

There was a proverb, "The Mayor of Northampton opens oysters with his dagger;" a shorter instrument bringing them too near his judicial nose. The Hon. Robert Boyle, in his well-known "Reflections," speaks in abhorrence of the practice of "eating raw oysters." Dr. Johnson could not agree with Boyle, and went so far in

(*h*) "Adventures of an Oyster."

his dislike as to compare scalloped oysters to "children's ears in sawdust."

The poet Cowper liked oysters in all ways ; and in one of his letters to Mrs. Newton, in Mrs. Unwin's name and his own, he says, " We return you many thanks for a pot of scallops, excellently pickled." In reference to the present of a barrel of oysters sent him by the above named lady, he wrote

" A noble theme demands a noble verse,
In such I thank you for your fine *oysters* ;
The barrel was magnificently large,
But, being sent to Olney at free charge,
Was not inserted in the driver's list,
And therefore overlook'd, forgot, or miss'd."

Then follows a particular relation of its recovery, and having offered the advice that all such " commodities " should be forwarded by what was called the " Diligence," the poet thus concludes :—

" We therefore recommend it with the aim
To save at least three days,—the price the same ;
For though it will not carry or convey
For less than twelve pence, send whate'er you may,
For oysters bred upon the salt sea-shore,
Packed in a barrel, they will charge no more."

The Acts of Parliament relative to the protection of the oyster, from his greatest enemy, man, are given in the thirty-second chapter, it only remains to state, in concluding this, that in America, where the quality of the native oyster, though little inferior to the larger species of Britain, is greatly over-rated, the legislature, some years since, was called upon to make a similar provision for the protection of the oyster.

CHAPTER IV.

WHAT IS AN OYSTER?

THE OYSTER NOT A FISH—A MOLLUSC DESCRIBED—THE OYSTER NOT A FLUVIATILE CREATURE—OYSTERS WHICH GROW ON TREES—MARINE RANGE OF THE OYSTER—ANSWER TO THE QUESTION FIRST PROPOSED.

IN England, “oyster” (formerly “oister” and in Cornwall “estren”) Germany, “auster,” France, “huitre,” Holland, “oester,” Sweden, “ostra,” Denmark, “oster,” Russia, “ystritz,” Spain, “ostra,” Italy, “ostrega,” or “ostrica.”

The oyster is a classical character; and its praises have been said or sung by innumerable writers from Aristotle to “Professor” Blezard. It furnished Shakespeare with many a playful allusion; and the philosophical question which he makes the fool ask of Lear, as to the mode of constructing its shell, would be difficult for the best conchologist to answer satisfactorily. It has even been celebrated in pastoral verse. Sannazzaro, an eccentric Italian writer of the last century, changed the scene in this kind of poetry from woods and lawns to the barren beach and boundless ocean, introducing sea-calves in the room of kids and lambs, seamews for the lark and the linnet, and presenting his mistress with oysters instead of fruits and flowers. There is no lack of gossip on the subject.

There are many instances in which the name of a creature gives some indication of what it is: as, a bird is designated "the cuckoo" from its well-known note; and an insect is called "the carpenter bee," from its movements resembling those of that well-known artisan; but the oyster cannot be cited as an example of this kind. Its earliest names in Greek and Latin are derived from the words *ostreon* and *ostrea*, the terms applied to bones, which attracted earlier attention than shells, and from their being alike hard substances.

The oyster is usually described as a shell-*fish*; but it is so very erroneously. A fish has a bony or cartilaginous skeleton; it swims, too, by the action of its fins; and in these respects, not to mention others, it is clearly distinguished in its structure from the oyster. In no sense of the word is the term *fish* applicable to this animal.

The place assigned to it by naturalists among the *mollusca* gives a clue to its just appreciation; that appellation being derived from the Latin word *mollis*, which means *soft* and applied to all soft-bodied creatures, whether having shells or not. The oyster is, therefore, properly speaking, a mollusc, and is protected by an upper and an under shell. "Such a life and such a habitation!" says Michelet. "In no other creature is there the same identity between the inhabitant and the nest. Drawn from its own substance, the edifice is the continuation of its fleshy mantle. It follows its forms and tints. The architect has communicated its own substance to the edifice." The shell of the Mollusca has been variously accounted for by naturalists. "We might regard the shell as the bone of the animal which occupies it," says a celebrated French Naturalist; and then he gives expression to a very different view. "We may say as a general thesis

that testaceous molluscs are animals with whom ossification is thrown out on the external surface in place of the interior, as in the mammals, birds, reptiles, and fishes. In the case of the superior animals the bones lie in the depths of the body; in the shelled Mollusca the bones are placed on the superficies. It is the same system reversed." Other Zoologists reject as altogether untenable both these comparisons.

"The shell which serves as a dwelling and a shelter cannot," say these authors, "be considered as a skeleton, because it does not assume the external form of the animal; because it does not attach itself to the organs of locomotion; and, finally, because it is the product of secretion, which increases in proportion to the development of the body itself." (a) The last two reasons appear to me to be the most acceptable.

The upper shell is flat, thinner than the other, and marked by tolerably regular crescentic lines; the under shell is convex externally and concave internally, its outer surface is rugged, with bold transverse marks of growth, longitudinal ridges, and intervening furrows. It is much stouter than the flat shell, and is sometimes very thick and coarse.

This theory of the "*upper*" and "*under*" shell of the oyster, or the "*right*" and "*left*" valve belonging to it, has been strongly debated by naturalists, and in spite of seeming agreement amongst them at the present time relative thereto, the dispute crops up now and then only to come to an unsettled conclusion.

"Indeed, there have been so many controversies about the natural history of this animal as to render it impossible to narrate in the brief space I can devote to it a tenth part

(a) "The Ocean World," p. 316-17.

of what has been written or spoken about the life and habits of the 'breedy creature.' Every stage of its growth has been made the stand-point for a wrangle of some kind. As an example of the keenness with which each stage of oyster life is now being discussed, I may mention that some years ago a most amusing squabble broke out in the pages of the *Field* newspaper on an immaterial point of oyster life, which is worth noting here as an example of what can be said on either side of a question.

"The controversy hinged upon whether an oyster while on the bed lay on the flat or convex side. Mr. Frank Buckland, who originated the dispute, maintained that the right, proper, and natural position of the oyster, when at the bottom of the sea, is with the flat shell downwards; but the natural position of the oyster is of no practical importance whatever; and I know, from personal observation of the beds at Newhaven and Cockenzie, that oysters lie both ways,—indeed, with a dozen or two of dredges tearing over the beds it is impossible but that they must lie quite higgledy-piggledy, so to speak. A great deal that is incidentally interesting was brought up in the *Field* discussion.

"There have been several other disputes about points in the natural history of the oysters—one in particular as to whether that animal is provided with organs of vision. Various opinions have been enunciated as to whether an oyster has eyes, and one author asserts that it has so many as twenty-four, which again is denied, and the assertion made that the so-called eyes projecting from the border of the mantle have no optical power whatever; but, be that as it may, the oyster *has* a power of knowing the light from the dark." (b)

(b) "The Harvest of the Sea," p. 232.

Let it not be supposed, however, that anything more than a general description is given, when I say that, because of the oyster's testaceous dwelling, it is distinguished from many soft bodied animals as a *shelly* mollusc. Among these creatures a remarkable diversity prevails. Great indeed, is the contrast between the coarse, rough, yet finely sculptured and coloured individuals, usually denominated Rock Oysters, and the sleek looking creatures deposited in a barrel, bearing the name of "Burnham," or "Milton," or "Colchester." But so liable are the distinctive marks of these animals to change, and thence to form individual varieties, that it is extremely difficult to establish any brief description of the edible oyster, the *ostrea edulis*. Not merely have the oysters of different coasts their peculiarities, but every bay, estuary, harbour, or space in the sea has its local vicissitudes as to the supplies of food, depth of water, currents, tides, and other influential causes, all of which manifestly affect the figure or the shells of this species of oyster.

But, our oyster, a testaceous mollusc, is not to be classed with fluviatile beings.

An oyster is commonly associated with a river: with the Mersey, which rises in Yorkshire from different sources, in Clough Moss and Holme Moss; the Swale, which divides the Isle of Sheppy from the rest of Kent; and the Colne, which flows in the neighbourhood of Colchester. The term "natives," so familiar throughout the country, also sustains the idea that the oyster is derived from *river-water*. In this, however, there is a popular error; no river on the face of the earth provides for the production of this delicacy. It is undoubtedly of *marine* origin.

In the islands of the west, it is evident that the early voyagers were not such fabricators of stories as they have

been sometimes supposed. They declared, for instance, that there oysters might be seen *growing on trees*; and the statement was not merely denounced as incredible, but as absolutely false. But, as many facts attested by Bruce met with direct contradiction, yet have since been placed beyond all doubt by the testimony of numerous and unimpeachable witnesses, so has it proved with the one just mentioned. How wise is it, then, to guard against extremes! The scepticism on which some pride themselves is closely allied with the credulity they affect to despise. Many are the statements of science which are not merely startling but confounding; they may even involve what we have previously deemed to be impossible; yet the more we listen to them intelligently, the more shall we be disposed to take up a central position far away from the two opposite evils.

If we do so in the present instance, we shall find that the common mangrove, and also others of its tribe, (*c*) are to be observed all along the shores of the tropics, both in the new and the old world, rooting themselves in the mud—the very soil for which they are expressly designed—and forming dense forests, even at the verge of the ocean, and below high-water mark. Peculiar as the plants of this family are for the germination of their seeds, even while attached to the branches, they are equally so for the numerous root-like projections which serve as so many supports to the stem; hence, on the retiring of the tide, and on the margins of the great rivers which are fringed by these trees in tropical climates, the stems may often be seen covered with oysters. The species thus found is expressly called the “*tree oyster*.” (*d*) The negroes living

(*c*) Rhizophoræ.

(*d*) Ostrea arborea.

on the sea-shore, or the river bank, are accustomed to lop off a branch from a mangrove laden with well-filled shells, obtaining by one stroke of the axe a bounteous and valuable supply. A branch that has many offsets is a sufficient burden for any one man to carry; and Adamson states, that the oysters they yield are as delicate in taste as our own. (*e*)

Oysters abound in other parts of the world, as in the islands of the East Indian Archipelago, having on the east the Pacific, on the west the Indian Ocean, on the north the Indo-Chinese countries and China, and on the south New Holland and New Guinea. A bay on the south-west of New Holland, and north of King George's Sound, discovered by Vancouver, is called Oyster Harbour, from the number of these creatures that are found there. Another spot, of a similar kind, is situated in the Bay of Bengal, and called Oyster Island; it is surrounded by rocks, and is extremely dangerous to vessels from its rising very little above the level of the sea. The island abounds with small rock oysters, which the natives of the opposite coast detach with hammers, and then carry to Chittagong, from whence they are conveyed to Dacca and Calcutta.

But where, and how, it may be asked, is the oyster born? This inquiry, then, I proceed to answer in the next chapter.

(*e*) "Adventures of an Oyster."

CHAPTER V.

THE STRUCTURE OF THE OYSTER.

THE PHRASE "STUPID AS AN OYSTER"—HEADLESS BEINGS—THE
MANTLE OF THE OYSTER—THE STOMACH—THE LIVER—THE
HEART—THE BREATHING ORGANS—THE ORGANS OF NUTRI-
TION.

YES ! I have decided thus to head this chapter rather than adopt the somewhat repellant "Anatomy," which, if it were placed as the finger-post to the path of knowledge in this scientific portion of my book, would, doubtless point to the opposite direction to that in which I am anxious that both my oyster-eating and non-oyster-eating reader should travel.

In other words, I quite agree with M. Moguin-Tandon, (a) that :—"It is an open question whether it is judicious to enter into the details of the anatomical structure of the oyster ; for, generally, when we dissect an animal it certainly does not improve our relish in eating it ; and, moreover, zoologists who know—*ex professo*—the anatomical structure of the mollusc, tell us they try to forget their knowledge when they are eating oysters. This is the

(a) "The World of the Sea." p. 197.

reason why we have introduced, with some little hesitation, into our work any structural details of these celebrated, though badly-treated, bivalves. But we warn the reader, if he is about to indulge in an oyster supper, not to read the description we are giving, lest by any chance it should blunt the edge of his appetite."

"Stupid as an oyster" has become a proverb. Of this Shakespeare was cognisant, as is evident when Benedick, describing the strange change that had passed on Claudio, says :—" He was wont to speak plain and to the purpose, like an honest man and a soldier, and now is he turned orthographer ; his words are a very fantastical banquet—just so many strange dishes. May I be so converted, and see with these eyes ? I cannot tell ; I think not ; I will not be sworn, but love may transform me to an oyster ; but I'll take my oath on it, till he have made an oyster of me, he shall never make me such a fool." (*b*)

It is said of some persons, "they have no head." Not that they are supposed to resemble the sign of "the good woman," which may, perhaps, sometimes be seen as a headless figure ; much less that they walk abroad as the Parisians say St. Denis did, carrying his head in his hand. The declaration is evidently figurative, and denotes that such persons make no proper use of their heads, and act with so total a want of all thought and discretion, that it is as if they had actually none.

But to say an oyster has no head is to state a literal fact. Accordingly it is ranged by naturalists among *headless* beings ; (*Acephala*) and unquestionably it is manifestly inferior to those which are gifted with a brain. Such creatures, prepared for a higher order of instinct, often

(*b*) "Much Ado about Nothing," Act 2, Scene 3.

delight and astonish us ; as the spider, when spinning its web on the garden wall with admirable precision ; or the bees, in all the economy of the hive, subject as they are to the authority of a queenly presence, from which, like the attendants of a court, no one retires except by a backward movement.

If, however, there are tribes of beings far superior to the oyster, it is still fully prepared for the condition it is destined to occupy. Its internal structure is admirably perfect, and, however regarded, it is obviously suited to a passive life. A creature designed for locomotion has evidences of existing things, sometimes to supply its wants, and at others to apprise it of danger ; but of these the oyster is destitute, for, being destined to rely entirely on its fixed resources, any other powers would tantalise it in vain.

The body occupies the great concavity of the under shell, presenting to view a squared margin, opposite to the hinge, and a projecting margin along its two sides. The surfaces of the body have a lacework of fat when the oyster is in good condition. The marginal borders, proceeding alike from the upper and under surfaces, are gradually extended as they advance towards the edges of the shells, and they form the outline of those extended membranes to which the names of the pallium, the coverlet, and the mantle have been given.

That a clear idea may be formed of this very remarkable portion of the oyster, it may be still further observed, that if one of these creatures be placed with its convex shell downwards, and having the hinge next the observer, the right and left sides will then be determined. (c)

(c) This is a vexatious point, and has been, and still is a matter of dispute amongst naturalists.

The lower folds of the mantle then become united on the right side, nearly opposite to the muscular ligament, and they form an entrance to the interior of the branchiæ, or breathing organs, which has been termed the branchial porch. The mantle is free throughout its circumference, except a part of its margin on the straight side, where it forms a kind of a hood.

The oyster has a mouth, placed at the narrowest part of the body—a simple orifice with no kind of teeth, but bordered by four thin lips, ranged on the two sides of the aperture, and is represented covered by a part of the mantle. The tube called œsophagus, from two Greek words meaning “I eat,” and “to carry,” and more commonly the gullet, is extremely short, so that in such creatures the mouth appears to open into the stomach.

The stomach is a kind of bag, placed immediately behind the opening of the mouth; and when, in any instance, the stomach is cut open, it will show the apertures of several large vessels, by which the bile is conveyed from the liver—an organ which entirely surrounds the stomach.

The liver is very large, of a greenish and sometimes a dark chocolate colour. Externally it exhibits a regular series of equal-sized granules, which may be shown by boiling the oyster, and then tearing off its loosened external covering. Internally it presents arborescent vessels, which converge into excretory ducts, as they approach the stomach. The minute vessels of the liver assume a grape-like figure, common to all the higher order of animals.

The intestine is comparatively short, bending on itself, winding round the liver, and terminating at the part opposite the mouth.

Instead of what is, properly speaking, a brain, two minute detached nodules are observable, each having a few slender threads passing to the neighbouring parts, the longest being affixed to the gullet, and thus it is evident that the chief preserving sense is given to test the articles of food.

The heart, a beautiful structure, is situated in a cavity between the folds of the intestine. It has two chambers: an auricle, and a ventricle, from the stomach. The auricle has walls, extremely thin, composed of the most delicate bundles of muscular fibre; it receives the blood from the respiratory apparatus, and, by contracting, transmits it through two intermediate canals into the more muscular ventricle, from whence it is propelled throughout the body. The vessels connected with it are as admirably adapted to their proper service, and are as beautifully arranged as these parts are in the camel, the elephant, or even in man. There are three principal branches: one leading to the mouth, the second leading to the liver and stomach, and the third to the hinder part of the body.

The fluid contained in the heart does not coagulate spontaneously, and it holds in solution the same proportion of sea-salt with the surrounding water. Two other remarkable facts may be noticed; the muscular flesh of the ventricle is soft and tender, like that of a chick in the first stage of incubation; the auricle is of a black colour throughout its tissue.

Another power is still required:—

“The vital air

Pervades the swarming seas and heaving earths,
Where teeming Nature broods her myriad births;
Fills the fine lungs of all that breathe or bud,

Warms the new heart, and dyes the gushing blood ;
With life's first spark inspires the organic frame,
And, as it wastes, renews the subtle flame."

Accordingly, the oyster has organs of breathing which may be more readily understood by the examination, often practicable, of another creature.

Such for example, is the *Pholas*, of which we have several British species, occasionally contenting themselves with houses of clay, but commonly boring an abode in sandstone or limestone rock, and, consequently, the precursors of the long series of cave-dwellers of which we have read in various parts of the earth. Their colonies may frequently be observed at low water mark in the masses of stone left uncovered by the retirement of the tide. How these recesses are made has long been a question which men of science have laboured to answer. (*d*)

The *Pholade* are a family which can bore out for themselves a residence in wood, or even stone. They appear to carry with them a graving tool, and the shell is fitted in a hole, as in a needle case. How can these animals bore their way into the very hardest rocks? Aldrovand believes that they were born in the bosom of the rock while it was in a soft state, and Réaumur shares this extraordinary opinion ; but this cannot explain their presence in logs of wood. Others have supposed that the current of water produced in the process of their respiration wore out the cavity by its continual erosion ; but this theory again is not supported by fact, for the pholas finishes its excavation in a few months, which could not possibly be the case if water were the only agent. Another supposition is, that the foot and the edge of the mantle are filled with siliceous particles, like sand-paper, which, by

continual friction, rub and wear down the rock, and file away its substance. Other naturalists suggest that the pholas may have the power of secreting a corroding liquid, by which the rock is eaten away. But then, how is the shell itself to escape the action of the liquid ?

To De Blainville belongs the honour of suggesting that a simple movement of the shell, constantly repeated, would in time pierce the stone. Observation has since decided that his opinion is correct ; the shell itself cannot be worn away by this process, because it is composed of aragonite, which is harder than the rock in which the animal burrows. The mollusc bores down a considerable depth, and then hollows out its home to accommodate its increasing bulk. Hence their lithodomes are bottle-shaped—wide at the bottom, with narrow necks. These little borers cannot but excite our wonder. Here are soft creatures, without the slightest consistency, capable of hollowing out for themselves homes in the hardest rocks ! Such is the power of life, even in its lowest development, over inanimate matter. (*e*)

If the reader should have the opportunity, in some ramble on the coast, let him strike the beach with a stick, or only tread heavily, and he may, perchance, frighten a pholas, and cause it to spirt water from its sandy dwelling, and, thus apprised of its site, dislodge it as a prize. Let it now be placed in a vessel of sea-water, and two currents will be observed issuing with surprising force : the one inhalant, and the other exhalant ; the former having an orifice somewhat like a trumpet, exquisitely fringed, carries into the body of the creature all the floating par-

(*e*) "The World of the Sea," pp. 188-90.

For further information, see the above : English Translation. Cassell & Co., London.

ticles the water contains, the latter showing that they tarry on their way, for the outgoing stream is perfectly clear. Here is, in fact, an animal-filtering machine—even turbid water becomes clear in the passage ; and if indigo be thrown into clear water, the effect will be strikingly manifest. If, too, the pholas be suddenly taken out of the vessel, the orifices will be closed so that no water can escape, though soon after they will relax, and it will again be spirted out. In this way, then, does the oyster receive and expel water, from vessels similar in their kind, and thus its respiration is absolutely complete.

Messrs. Alder and Hancock, to whose researches natural history is greatly indebted, have described this beautiful structure as seen under the microscope. Between the gill-plates there are tubes, not unlike those with which we are familiar, as pipes of lead or clay, each consisting of one substance. The walls of the tubes, so to speak, are a regular network, composed of blood-vessels, those passing transversely being the stronger and more prominent. The vessels placed lengthwise, standing a little distance from each other, give to the meshes the form of parallelograms—figures greater in length than in width. The meshes, moreover, are open spaces, fringed internally with a narrow membrane and active vibratile cilia, which may be described as extremely fine hairs, the name given to them being taken from the Latin word for eye-lashes. Thus the breathing organs of the oyster are nearly the same as the gills of fishes ; they form, in fact, in a kind of network, two double series of vessels on each side the body, imbibing oxygen—that pabulum of life—and emitting the carbonic acid that is generated during the circulation of the blood, as completely as these processes occur in the largest animals.

If, for example, the shell of an oyster be carefully opened, and as little as possible of the fluid within be spilled, a pair of fine scissors will readily remove a portion of one of the gills. Placing this upon a slide, adding a drop or two of the fluid, separating the filaments one from another, and covering the specimen lightly with a thin piece of glass, it is perfectly ready for examination by the microscope. This instrument will show the cilia forming several rows, beating and lashing the water, and producing in it an infinity of currents.

Well might old Leeuwenhœck exclaim, as he looked through his microscope at the beard of one of these creatures, "The motion I saw in the small component parts of it was so incredibly great, that I could not be satisfied with the spectacle; and it is not in the mind of man to conceive all the motions which I beheld within the compass of a grain of sand." And yet the indefatigable Dutch naturalist beheld but a dim and misty indication of the exquisite ciliary apparatus by which these motions are effected, compared with what may be witnessed by the aid of the much improved instruments of our own time.

On functions so mysterious and marvellous, shrouding in darkness the proudest ingenuity of man, and leading us directly to contemplate the glory of the Infinite, whose

"——— creating hand

Nothing imperfect, or deficient, left

Of all that He created,"

depends the growth no less than the life of an oyster. Wonderful oyster! only like a drop of candle-grease at first, and, on the third day after "the spat" was cast, a quarter of an inch in width, and, in three months, as large as a shilling; how it could become so is an interesting question.

The ocean teems with life. But how can the oyster avail itself of the plenteous banquet? Other creatures go hither and thither at pleasure. The lion roams the forest, the eagle soars aloft on mighty wing, the fish glides gently, or darts rapidly through the waters, and the dragon-fly passes with a brilliant flash through the air, each one to rejoice in the seizure of its prey. There are limes and scallops, too—molluscs like the oyster—which are called “the butterflies of the ocean,” not only from the delicacy and beautiful colouring of the wing-like shell, but also from their agile motions. It is only for one of these creatures to open the valves of its shell and suddenly to close them, and it so discharges the water that the lime or the scallop is impelled onwards or upwards. When this force is spent it repeats the operation, thus taking long and rapid leaps, and shooting hither and thither in an irregular and zigzag course.

But the oyster is not thus gifted with the power of flight, or even of motion. It remains day after day, week after week, month after month, it may be year after year, fixed where it was, and has no more ability of transition to another spot, even at the distance of an inch than the rock itself.

The oyster has not even a tongue, which is granted to some little creatures, as the trochus or common top. This tongue, is, in fact, an extremely delicate ribbon, of a transparent substance, on which teeth are placed, of a texture glassy and brilliant. These teeth are arranged in three rows: the middle ones being three-pointed, while in the two other rows there is the alternation of a three-pointed tooth with a larger one, which has a somewhat boat-like appearance. As the teeth project from the surface of the tongue in hooked curves, and all point in

the same direction, the tongue acts like a rasp, the projecting teeth abrading the surface of the plants, just as the horny papillæ of the lion's tongue act on the flesh of the stag, or any other of his victims. The periwinkle, too, has a similar structure. And yet of the oysters race, firmly attached to their rocky homes it may be said :—

“ ———In their pearly shells at ease, attend
Moist nourishment.”

The mode by which this is obtained may well recall the words of the poet :—

“ In human works, though laboured on with pain,
A thousand movements scarce one purpose gain ;
In God's, one single can its end produce,
Yet serves to second, too, some other use.”

The two vascular laminæ already described, forming the gill-plate, are really sieves to separate suspended atoms from the surrounding water, on its passage from the inhalant to the exhalant orifice, a structure perfectly adapted not only to a breathing, but a feeding apparatus. The action that takes place is as remarkable as the structure. For the tubes that pass between these living sieves lead directly to the exhalant syphon. Thus, when from this the water flows out, there is a tendency to form a vacuum in the chamber and in all the tubes within the gill laminæ ; and by this means, combined with the action of the cilia lining the meshes, the water introduced into the branchial chamber by the inhalant tube is drawn to the meshes, and all the suspended particles of matter are retained on the surface of the gill.

The water being filtered, as it were, allows the particles to accumulate, and then by the aid of other cilia they are formed into defined streams. This is certainly one of the most beautifully adapted organic mechanisms that can be

observed. As a breathing organ it is perfect ; and as an organ for securing food it is surely unrivalled for the exquisite beauty of its structure. (*f*)

To adopt the eloquent words of Professor T. R. Jones, (*g*) "Wonderful, indeed, is the elaborate mechanism employed to effect the double purpose of renewing the respired fluid, and feeding the helpless inhabitants of these shells! Every filament of the branchial fringe, examined under a powerful microscope, is found to be covered with countless cilia in constant vibration, causing, by their united efforts, powerful and rapid currents, which, sweeping over the entire surface of the gills, hurry towards the mouth whatever floating animalcules or nutritious particles may be brought within the limits of their action, and thus bring streams of nutritive molecules to the very aperture through which they are conveyed to the stomach, the lips and labial fringes acting as sentinels to admit or refuse entrance, as the matter supplied may be of a wholesome or pernicious character. So energetic is the ciliary movement over the entire extent of the branchial organs, that if any portion of the gills be cut off with scissors it immediately swims away, and continues to row itself in a given direction as long as the cilia on its surface continue their movements."

Nor should we omit to observe that several transparent arborescing blood vessels are placed between the outer membrane and the substances of the body, and on the lips of the oyster, which are visible to the unaided eye, from their continuity with the opaque fat. As all the impressions made on the oyster are those of immediate contact, every part of its exterior surface appears highly sensitive.

(*f*) "Annals of Natural History," vol. 8, pp. 375, 376.

(*g*) "Animal Kingdom."

Fishermen say that if the water is clear where these creatures are lying in their beds, they may be seen to close their shells whenever the shadow of a boat passes over them. The muscular borders of the mantle, especially, are irritable; they are, in fact, adapted to withdraw themselves from hurtful impressions, and by pulling the associated tendons against the central muscle, this also becomes excited, and the oyster immediately closes its shells.

Attention is sometimes directed to a "little wonder." We remember, for instance, an ingenious mechanic constructing many years ago, a working steam-engine, the packing-case of which was a walnut shell. A visitor who was looking at it, finding it suddenly stop, inquired the cause, when the engineer replying that the safety-valve was not quite right, he exclaimed, in astonishment: "Safety-valve! I have not yet been able to see the fly-wheel!"

We have heard of mechanism still more minute. Yet, let the smallest machine ever constructed be produced, and it shrinks into abject insignificance when compared with "*Silver-shell*," (the oyster) which had all the organs now described, when as a tiny drop it alighted on the rock where, for a time, it was to live and grow. Yes! even then did that vitalised atom inhale the air, select its appropriate food, swallow it, digest it, and derive nutriment from it, while the liver rendered its essential service, and the aerating organs purifying the blood, the heart urged the little stream through all the vessels of the oyster's frame! The mighty ocean, as its waves rolled over it, was subservient to its life and its pleasures. The billows wafted fresh and choice food within its reach, and the flow of the current fed it without requiring an effort; while every atom

of water that came in contact with its delicate gills, yielded its imprisoned air to freshen and invigorate the little creature's blood.

In another respect, as certainly, the most exquisite of minute machines can bear no comparison with the oyster. The watch, so small that it might be worn on a finger-ring, justly demands praise for the hands that have fashioned it with exquisite skill. But what would be said if it grew to the size of a chronometer, maintaining throughout the form of its respective parts, and all combining in continuous operation the same accuracy and harmony of movement? Yet the oyster thus grew: so small at first, that two million such beings would occupy only a single square inch; in six months it would cover half-a-crown, and in twelve a crown piece.

Were there only one such creature, what a marvel it would be! Is it less amazing because the oyster was only a unit among countless millions? Other wonders, however, remain to be narrated. (*h*)

(*h*) "Adventures of an Oyster," pp. 28-30.



CHAPTER VI.

THE HOUSE THAT THE OYSTER BUILT.

THE FIRST SHELL—HOW TO TELL THE AGE OF AN OYSTER—
WONDERFUL PROVISION FOR ITS GROWTH—SECRETOREY POWER
—IRIDESCENCE—THE ADDUCTOR MUSCLES—CREATURES LIVING
ON SHELLS—WONDERFUL TENACITY OF LIFE IN THE INFU-
SORIA—AGENCY OF LIFE—ANIMALS ATTACHED TO SHELLS—
CRETION OF CARBONATE OF LIME BY ANIMALS.

THE oyster might properly be denominated its own architect and builder, even from the time when it first fell from the briny waters on one of the rocks beneath ; for not only was there a minute animal, but a covering for it of two valves, or shelly plates, exquisitely adapted to its comfort and security. All molluscs having shells, whether *univalve*, like the limpet ; *bivalve*, like the mussel or the oyster ; or *multivalve*, like the balanus, so plentifully scattered over the rocks of our coasts, are similarly provided for ; the minute creature having, at its first development, a shelly covering of one or more pieces.

But the oyster, as we have seen, grew rapidly, and hence, were there no provision against it, serious evil might arise. The accident of his house becoming too small for him could not occur to the oyster. And why ?

Because the shell grew exactly in proportion to the size of its inmate. Shakespeare has made the fool ask Lear, "Dost know how an oyster makes its shell?" only to remind the poor king, however, of his houseless state ; but were it repeated now among oyster-eaters, it is probable that but few would be prepared for an intelligent reply. (a)

If we cannot answer the Fool's question in Lear, we can, nevertheless, tell by his shell what is his age.

"A London oysterman," says a correspondent of No. 623 of the "Family Herald," "can tell the ages of his flock to a nicety. The age of an oyster is not to be found out by looking into its mouth. It bears its years upon its back. Everybody who has handled an oyster-shell must have observed that it seemed as if composed of successive layers or plates overlapping each other. These are technically termed 'shoots,' and each of them marks a year's growth ; so that, by counting them, we can determine at a glance the year when the creature came into the world. Up to the time of its maturity the shoots are regular and successive ; but after that time they become irregular, and are piled one over the other, so that the shell becomes more and more thickened and bulky. Judging from the great thickness to which some oyster-shells have attained, this mollusc is capable, if left to its natural changes unmolested, of attaining a great age." Indeed, fossil oysters have been seen, of which each shell was nine inches thick, whence they may be concluded to have been more than 100 years old.

In offering a reply to the question, "How does the oyster make its shell?" it should be observed that an oyster is endowed, like other animals, as well as plants,

(a) "Silver-shell ; or, The Adventures of an Oyster."

with a power of secretion : the process of separating certain matters from the nutritious fluids of the body. It is probable that in almost every such act a double purpose is served ; the blood being freed from particles which would become superfluous or injurious, and the fluid separated answering some secondary purpose. The process, common as it is, in all its essential features, to vegetables and animals, is everywhere performed by the same agency, the development of single cells, each possessing its own independent vitality. It is a part of their regular actions to secrete and withdraw certain ingredients from the nutritious fluids, and afterwards to set them free again, either by passing through in perspirable vapour, or the rupture of the cell-wall.

Now the oyster secretes a calcareous, earthy matter, precisely adapted to the enlargement of its dwelling, by means of its mantle, the outer membranous layer which invests its body. Whatever, indeed, be the form of a shell, (and shells partake of a marvellous variety,) the additions required by growth, according to the law of its kind, both in shape and colour, are ascribable to the wonder-working mantle of the inmate.

Duly provided for its work by the secretion of the necessary matter, and by the instinct for its proper use, the oyster begins the enlargement of its shell ; for this the margin of the mantle protrudes, and firmly adheres all round the circumference of the valve with which it corresponds. Thus the calcareous matter is gradually deposited in a soft state on the extreme edge of the shell, and, becoming hardened, it is converted into a shelly layer ; the process being repeated at intervals, every newly-formed layer enlarges the diameter of the shell. Thus the shell corresponds in its increase with the growth of its tenant.

Nor is this all : a minute mechanism may be traced in each layer. On the outer surface of oyster shells there are fine thread-like lines, or streaks, which are called *striæ*. And on this fact Lord Brougham and Sir C. Bell remark : “We should be inclined to say that the earthy matter crystallises, were it not that the striated or fibrous appearance differs in the direction of the fibres in each successive stratum, each layer having the *striæ* composing it parallel to one another, but directed obliquely to those of the layer previously formed, and the shell exhibiting a strong texture arranged upon well known mechanical principles.”

The oyster does not adorn its shell, as some of the soft-bodied creatures do theirs. Their various and often splendid hues are owing to glands situated on the margin of the mantle, and curiously endowed with the power of depositing colouring matter. In many instances an accordance is observable between the patterns or tracings on the shell and the colours as arranged in the organ that secretes them. Thus, in the Banded Snail, there are just as many coloured spots on the edge of this organ as there are zones on the shell, and when a part of the shell is removed, for the sake of experiment, the piece reproduced is brown exactly opposite the dark portion of the organ, and yellow in the other parts. The oyster, however, diffuses throughout its exterior only a brown tint. I need hardly remind the reader that the latter sentence is used in a general sense, and only applies to the mollusc as seen in our “sea-girt Isle;” for the oyster bears different names in accordance to the localities in which it is found, whether on rocky ground, mud, or sand, and has different colours in different places. In Spain, oysters are found of a red and russet colour ; in Illyria they are brown, but the fish is black, and in the Red Sea, of the colours of the rainbow.

The green oyster, the Parisian delicacy, is brought from Brittany; but the same flavour and colour can be produced by putting oysters into pits where the water is about three feet deep, in the salt marshes, and where the sun has great power. In these they become green in three or four days; for these colours (as elsewhere stated) are derived from the elementary substance on which they feed—not, however, that it produces any peculiar difference as to flavour.

The inner part of an oyster shell is a great contrast to its exterior. As we examine it, we cannot fail to be struck with its silver-like hue and its exquisite smoothness, so completely adapted to the form and comfort of the little in-dweller; and when held to the light, a slight iridescence is frequently discoverable. The hard, silvery, brilliant internal layer of several kinds of shells reminds us of those described by Landor:—

“Of pearly hue

Within, and they that lustre have imbibed

In the sun's palace porch, where, when unyoked,

His chariot wheel stands midway in the wave;”

and the internal layer of oyster shells is often variegated with changing purple and azure.

The cause of this effect has been fully explained by Sir David Brewster, as suggested to him accidentally. He had fixed a piece of mother-of-pearl to an instrument for measuring angles by a cement of resin and bees-wax. On removing it from the cement when in a hard state, by insinuating the edge of a knife, and making it spring up, he found that the plate of mother-of-pearl had left a clean impression of its own surface, and had actually given the cement the property of exhibiting its own colours. The discovery was therefore made, to his great surprise and delight, that the cause, whatever it might be, of the colours

of mother-of-pearl, whenever apparent, does not depend on its chemical nature, but resides on its surface. In the examination of this substance with high magnifying powers, he perceived a grooved structure, closely resembling the delicate structure of the skin at the top of an infant's finger, or the minute corrugations often observable on surfaces which are covered with oil-paint or varnish. The wax, which exhibited the same colours, presented also a similar assemblage of grooves. Thus, as Sir Isaac Newton has shown that a series of grooves breaks up a beam of light that falls upon them into a number of separate parts, each of which is reflected to the eye from the bottom and sides of the little grooves, and assumes a particular colour according to the angle at which it is reflected, the cause of the iridescence was placed beyond all doubt. Subsequent experiments proved that this singularly beautiful appearance can be transferred to balsam of tolu, or to gum-arabic, by allowing a thin film to be pressed and to solidify between two pieces of mother-of-pearl ; or it may be communicated by hammering to a clean surface of lead, or to the well-known compound of mercury and bismuth, which forms a fusible metal. Different specimens of shell give, of course, very different results as to the fineness and number of the grooves. Sometimes a magnifying power of six or eight times will render them readily perceptible : in some instances two thousand grooves have been counted in the space of an inch, while in others their number was wholly incalculable. It is very remarkable that grinding will not obliterate these grooves. It might naturally be supposed that, as the grooves must be separated by slight ridges, those ridges would be worn down in the process of grinding. But as the ridges wear down, so also do the grooves ; so that, however thin the film may be rendered by grind-

ing, the grooves and the colours resulting from them will still be apparent. Still further: if the surface have any scratches or dents, the bottoms and sides are grooved just as if the surface had been level.

It follows from these facts that any mechanical contrivance by which similar grooves can be produced, must give rise to similar results; and this has been strikingly confirmed by Mr. Barton, of the Royal Mint. This gentleman constructed an engine by which he can engrave, on the surface of steel and other metals, lines so exquisitely minute that from 2,000 to 10,000 are included in a single inch. Such surfaces, when viewed on a cloudy day, present but few appearances of colour; but, when the light of the sun or of gas falls upon them, an extremely brilliant display of colours is the result:—every gradation of tint is exhibited, and a change is produced by every motion, either of the object or the source of the illumination.

Aquafortis or nitric acid, and the cutting engines of the lapidary will respectively separate mother-of-pearl, which is of a scaly, laminated structure, into a number of thin films, each surface of which presents the same beautifully coloured appearance. These are applied to a large variety of ornamental purposes, in the same way as tortoiseshell or the veneers of fancy woods, among which are handles for pen-knives, combs, buttons, spoons, and the inlaying of work-boxes and dressing-cases.

Devices or patterns are often drawn upon the films or plates with opaque turpentine varnish. The shell is then repeatedly brushed over with strong nitric acid by which the parts, which have not been covered with the varnish, are eaten away. An oil of turpentine being employed to wash off the varnish, the device which had been traced

appears in relief. When it is intended that this should be cut out, this can be done with a fine frame-saw, or a knife-edged tool. Should several devices be required of the same shape and size, a number of films of shell are glued together into a compact mass. The ornament is then drawn on one of the two exterior films, and the saw is employed to cut through the whole at one time. The mass is then put into warm water, which softens the glue, and the various pieces are separated one from another.

But the enlargement and decoration of its dwelling is not the limit of the oyster's curious power. The shell becomes gradually much thicker, and on the agency that produces this change we are happily left in no doubt.

Professor R. Jones observes :—“ While the margin of the mantle is the sole agent in enlarging the *circumference* of the shell, its growth in *thickness* is accomplished by a secretion of a kind of calcareous varnish, derived from the external surface of the mantle generally; which, being deposited layer by layer over the whole interior of the previously existing shell, progressively adds to its weight and solidity.” (b)

The fact is equally deserving of notice that, as glands are situated only in the circumference of the mantle, no colouring matter is ever mixed with the layers that increase the thickness of the shell. And why? Because, were it otherwise, there would be a loss of the secreted substance; and economy is one of the laws of creation. As it is, the substance always continues of a delicate white hue, and forms what is called nacre, or mother-of-pearl.

“ In structure, the nacre is very dense, hard, and firmly laminated; but the superficial outer layer is made up of

small polygonal prisms, and is somewhat friable. Each of these substances, the nacreous and the prismatic, consists of layers of organic matter impregnated with salts of lime." (*c*)

Even now we have not exhausted the wonders of the oyster's shell; for its two valves are not loose, like the plate that holds the bachelor's solitary muffin and the one that is placed upon it to preserve its warmth; nor are they like the paper covers of a book, either of which gives way on a slight wrench. On the contrary, they are united at the back by a hinge-joint, artificially constructed, and secured by a substance of great strength.

According to the oyster's ordinary state, its abode is kept open for a little distance, so as to allow the ingress and egress of the water indispensable for respiration and nourishment; (*d*) but as a security against danger, the in-dweller is able to close its shell, and firmly to hold its valves together. Of this power many an opener of oysters has had full evidence; for there is no little difficulty in

(*c*) Professor T. H. Huxley. A Lecture delivered at the Royal Institution, Friday, May 11, 1889.

(*d*) Relative to the tiny organisms only visible under the microscope, and called by scientists "infusoria," the following items may prove interesting to the reader:—By way of experiment, some of the infusoria, along with some fragments of putrid fungi, were violently boiled for several minutes, and immediately afterwards sealed up. As long as they remained sealed up, no signs of life were visible; but when, after several months, the flask containing them was opened, the infusoria almost immediately showed signs of returning animation, and in a few hours were as full of life as if they had never been boiled. It has also been demonstrated that they are equally well able to bear cold, for in a decoction containing some of them, after being frozen solid for a week, it was found, on thawing, that the infusoria were as lusty and active as ever.

working in the point of the knife, and when the two valves are separated, it requires a considerable wrench to tear them asunder. This is the effect of two strong muscles placed between the valves, their fibres passing directly across from the inner surface of the one to that of the other, and firmly attached to both. In a pair of fresh oyster-shells weighing 3,488 grains, the entire spring of the hinge weighed three grains and a half; and its elastic power was equal to the pressure of three pounds fifteen ounces avoirdupois, when placed upon the centre of the flat valve, and confined to the insertion of the valvular muscle.

How then, is our admiration demanded by the structure of a shell! Utterly destitute of vitality, with no vessels permeating its substance, and as incapable of expansion by any internal power as the rock on which it grows, what astounding marvels does it exhibit! We ask, By what agency are they wrought? and the only answer that can be given leaves us involved in mystery: It is the agency of *life*. (e)

To adopt the words of an eminent naturalist, Dr. W. Harvey: "Every plant and every animal is, while its life endures, a personal fellow-worker with the Deity,—not creating, as He creates, absolutely, but an author of relative creations—an agent in His Hand of changes which force merely physical could never compass. The growth of cellular or vascular tissue, whereby the body, once but a living speck, becomes what God has destined it to become; the internal action of organised bodies,—animal will,—the reproduction of the species, all these are utterly antagonistic to the physical laws of matter. They are manifestations of that other agency—life, an attribute of the personal God; and

while the portion of the life committed to each lasts, the body performs its wondrous functions."

The sketch now given of the wonders of an oyster-shell, would be wanting in one interesting particular, if no notice were taken of the fact that this house of a living creature commonly becomes the residence of a multitude of others. (*f*) There, for instance, grow corallines, which certainly have nothing in their appearance, when collapsed and removed from their native element, to attract attention. But only let one of the finest fronds of one called the "sickle beard" be taken and dipped in water, and it will spread out into a beautiful white plume, with rows of cups on the edges of its fibrils, and others about its stem, each cup containing a flower-like head of the animal, whose tentacles collect the food for its support.

There, too, may be observed little shelly rugged tubes, the dwellings of very different creatures, clustering on oyster as well as other shells, and whatever else may have lain at the bottom of the sea. Beautiful and graceful is the serpulæ as it issues from its tube, waving its breathing organs of exquisite structure, adorned with the richest tints of yellow, violet, azure, or crimson, before the unassisted eye. Nor less admirable in structure is that little inverted cone-like body, to open and close the tube, which is pushed out of the way of the organs of respiration.

But to give only another instance of this kind, it may be stated that Professor Allman, a very vigilant and careful

(*f*) "Innumerable other animals, sponges, corallines, polypes, tunicates, other bivalve molluscs, especially mussels and cockles, live in the same way and abound on oyster beds, often attached to the shells of the oysters. Professor Möbius counted as many as 221 distinct animals of various species on one oyster shell."—*Professor Huxley, on the Oyster.*

observer, found, at supper-table, an oyster shell infested by various creatures. On looking more intently, he discovered, what eyes less acute would have failed to perceive, some small white dots, irregularly placed on the surface of the fronds of some of these parasites. Laying, therefore, the oyster shell aside for further examination, and submitting a fragment to the microscope on the following day, he was soon rewarded with a sight of a delicate, glossy fan, and, in fact, with the discovery of a new plant. Each of the minute dots was now seen to consist of one or more, frequently of a cluster, of transparent fan-shaped bodies. Each dot, or cluster, crumbles under the touch, being composed of carbonate of lime: not as an incrustation, but as intimately incorporated with the tissues of the plant. (g)

(g) The reader will find a chemical analysis of the oyster in Chapter XVIII., but I have thought it of interest to the scientific reader to conclude the subject under review by quoting the substance of a Paper read by Mr. Robert Irvine, T.C.S., Edinburgh, 1889, relative to the "Secretion of Carbonate of Lime by Animals," in which it was stated that "hens supplied with any salt of lime produce normal egg-shells composed of carbonate of lime. They cannot make shells from magnesium or strontium carbonate. Crustacea, such as crabs, cannot assimilate sulphate of lime from the sea-water to form their exo-skeleton. They can form their shells from calcium chloride. In the egg-shell the organic and inorganic material are both secreted by cells separated from the epithelial cells. In the crab-shell, the organic material (chitin) remains attached to the epithelial cells, and in this the lime salts are deposited, probably by a process of dialysis, whilst, in the case of bone, the cells are not epithelial in character: the matrix, though separate, is closely associated with the cells, especially during its formation, and the lime is deposited in the matrix apparently by a process of dialysis. Phosphoric acid, combined with alkalies and alkaline earths, acts as the carrier of the lime salt to the secreting cells. While in the blood, the lime salt is a phosphate; it may be

thrown out mostly as carbonate, on meeting nascent carbonic acid at the secreting cells. Lime salts, of whatever form, are deposited only in vitally inactive tissues, such as bone matrix, chitin, or tissues that have undergone degeneration. Although the tissue be dead, deposition may go on."

Liebig says :—"The quantity of calcareous matter, from which the continued and immense construction of shell is derived, appears to be infinitesimally small—sea water containing $\frac{1}{12,400}$ of its weight of carbonate of lime, this being the principal ingredient of molluscous shells."



CHAPTER VII.

BIRTH, GROWTH AND REPRODUCTION OF OYSTERS

ON THE COAST—GREASE SPOTS FLOATING ON THE SEA—THEIR EXAMINATION BY THE MICROSCOPE—THE INFANT OYSTER AND ITS FIRST NUTRIMENT—ITS ATTACHMENT TO THE ROCK—THE BYSSUS OF THE MUSSEL—OPINIONS RELATIVE TO THE MODE OF REPRODUCTION—NUMBER OF YOUNG IN AN OYSTER—THE MATURITY OF THE “SPAT”—APPLICATION OF THE TERM “FALL” OF SPAT—THE PROCESS OF SPATTING—ACTIVITY OF LARVAL OYSTERS—RATE OF GROWTH—NATURAL TERM OF THE OYSTER’S LIFE—AT WHAT AGE IT ATTAINS ITS MAXIMUM PRODUCTIVITY—ITS EXTRAORDINARY ALTERNATION OF SEXES—CONTROVERSIES ABOUT OYSTER-LIFE—WHEN DO OYSTERS BECOME REPRODUCTIVE FOR DREDGING—WHY THE BALTIC IS DEVOID OF OYSTERS—WHITSTABLE AND THANET—COCKENZIE OYSTERS—LARGE SHELLS AND LITTLE MEAT—TEMPERATURE NECESSARY FOR THE CULTIVATION OF OYSTERS—MISCELLANEOUS FACTS—LIST OF THE GENUS OSTREA.

It is a morning in spring. Let us hasten together to the sea-shore, and inhale the healthy breeze which is being wafted over the waters.

Going close to their edge, we may discover patches of small bubbles, as of oil, or grease, floating on their surface. The sight is not unusual at certain periods, for such

floating masses are widely distributed by the flux and reflux of the tide ; and, strange to say, they are secure while other substances are in peril, for they are not exposed to destruction like the eggs and fry of various creatures, nor are they employed as bait or food for any tenants of the waters. Curious then, is such a mass ; but far more curious still will it appear if a portion of it be taken and minutely examined.

The earliest account we have of such inspection is that of the celebrated Anthony Van Leeuwenhœck, who, in a letter to the Royal Society, describes his being on the 3rd of September, 1697, at the house of a relation in Rotterdam, where he was regaled with English oysters, which had come that morning from Zealand. He opened about twenty-five, among which he found one which, when he held it so that the round part of the shell came next to him, the breadth of the oyster against his right hand appeared to be covered with a slimy substance. Doubting what it was, he rubbed some of it between his two fingers, and felt something sharp, but as this impression might have been produced by fine sand, he laid part of it on paper, and when he had returned home, and examined it by the microscope, "I saw," he says, "that all that imagined slime was nothing but young oysters ; and, though afterwards twenty-five oysters were opened in my presence, yet I could not find one more in which such a slime, or rather young oysters could be seen by the natural eye." (a)

The floating slime is, therefore, precisely the same substance that Leeuwenhœck thus examined. It is called the spat, and is in itself worthy of notice. So far from

(a) "Philosophical Transactions."

being an accidental appendage, it is an indispensable provision for the minute oysters, to which, both among animals and vegetables, there are many analogies. Within the husky covering of a grain of wheat, for example, is deposited not only the little germ of the future produce, but the albumen which is to yield it nourishment until the fibrous root it sends forth can derive support from the earth in which it is sown. In like manner, the chick in the egg, finds all that it requires, till the time of its escape, in the yolk by which it is surrounded.

Now, just what the albumen is to the germ—just what the yolk is to the chick, is that floating substance to the little oyster it contains. Even the eye might tell that it fully answers its purpose, but the ear cannot be placed in a sufficiently favourable position to hear the sounds—drop—drop—drop, though, at a certain crisis, the minute creatures must have received so much nutriment as to become too heavy to float, and therefore fall, in succession, into the depths beneath.

The first circumstance in the oyster's history, after falling from the surface of the waves, was its adhesion to the rock which was to be for a time its dwelling place. How then could this be produced? The common mussel obtains a mooring to its bed by a silken cable which it has the power of spinning for this purpose; and, strange to say, this very *byssus* or *beard*, has been employed to give strength to the works of man. At a long bridge over the Torridge river, in the county of Devon, the tide flows so rapidly that mortar or cement failing to keep it in repair, the interstices are filled with mussels, whose strong threads fixed to the stonework prevent the bridge being driven away; and so important is the aid of these little creatures that to remove them, except in the presence of the corpo-

rate authorities, is a crime, exposing the delinquent to the penalty of transportation. (*b*) But the oyster has no such power to attach itself to the rock; it is utterly unable to spin a thread. The common cockle digs its way into the sand, and there finds a home; but the oyster has not the curiously-formed foot with which its neighbour gains security from its foes. Yet it has all that is really necessary for its safety, for it can emit from its shell, young as it is, a calcareous and adhesive substance which holds it fast to the rock, where it continues to live and grow during successive months. (*c*)

The opinions of authors as to the mode of reproduction in the oyster may be divided into three: the first and oldest is that of Ulysses Aldrovand, who, under the head Generation, wrote as follows:—"Ostreorum ortus causa putredo quædam esse videtur." With this quotation I think we may at once dismiss the theory of putridity, from which our old author supposes the oyster to be born, merely mentioning that several others of the old writers were of the same opinion.

That mollusca are produced from ova appears to have been the discovery of an anonymous writer in the "Philosophical Magazine, 1603," who states that he saw the young snails issue from their eggs, and that he was afraid to give publicity to his discovery without the testimony of other witnesses. This position, however, namely that mollusca are produced from eggs, is not likely to be disputed in the present day.

The form which the young assume before quitting the ovary is a question to which I shall have to refer again;

(*b*) Daniell's "Rural Sports."

(*c*) "Adventures of an Oyster."

upon this state depends whether the animal is viviparous, ovoviviparous, or oviparous. The first of these terms refers to animals which bring forth their young alive, derived from two Latin words, *vivus*, alive, and *pario*, to bring forth. The second has the addition of *ovo* to it, from ovum, an egg, and applies to animals in which the young are hatched from eggs in the interior of the parent, without having any connexion with a uterus (or a womb.) The third, oviparous, to animals which bring forth eggs which are afterwards hatched.

Of the first mode of reproduction we have examples in man and other mammalia; of the second, among infusoria and some other animalculæ, numbers of which may be observed in any puddle; and of the third, birds form a good example.

All animals are either monœcious or dicecious: these terms were originally applied by Linnæus to two Classes of plants, the former having the male and female organs in different flowers on the same plant; the latter having the sexual organs distinct on separate plants: these terms are now applied also to animals. (*d*)

The first point to be considered is, to which of the first-named divisions the oyster belongs, viz.: viviparous, ovoviviparous, or oviparous. My own observations tend to establish the fact that they are ovoviviparous, in support of which view I shall now give a few extracts from the notebook of Professor Eyton, referring to numerous examinations of the ovaries previous to the expulsion of the young.

“ May 19.—Dissected and examined a large number of

(*d*) It may not be out of place here to remind the reader that, in Nature, no two animals, however like each other in figure or conformation, are of manner entirely the same.

oysters. . . . The ovaries of all were slightly distended, and full of spawn of various sizes when seen in the microscope under a $\frac{1}{4}$ inch power. In the smallest I could not perceive any motion ; but in the larger I could distinctly detect the vibratile cilia or feelers, as they would probably be termed by the fishermen, in active motion. The smaller ones were round, with a dark marginal rim, and some had indistinct lines radiating from the centre towards the margin : the larger ones were similar in shape to those obtained from Loch Ryan on the 10th of July, 1856, and exhibited to the British Association at Cheltenham : the interstices between the branchiæ and mantle were closely examined, but not a vestige of an ovum was to be seen."

In a footnote he says :—"The spermatozoa with cilia are, I should suppose, undoubtedly the perfect young ; but what are the other rounded bodies ? A few having been found with radiating lines, it appears likely that a subdivision takes place in an early stage, probably after fecundation. I did not see any spermatozoa that I could construe into male spermatozoa ; but I think it probable that they might be visible in the early part of the year, before the ovary begins to swell much."

"The oysters opened were from $2\frac{1}{2}$ inches to 3 inches in diameter, and had the smooth shell of 'natives;' those most advanced towards spawning had the margins of the branchiæ and mantle blackish, the others were of the usual colour of oysters in season. I placed some of the spawn freshly taken from the ovary in salt water, made after Gosse's receipt, in a glass tube : they gradually sank to the bottom, but at first appeared lively.

"May 23.—Received some oysters from Llandudno, in Caernarvonshire : they were of very large size, measuring

$4\frac{1}{2}$ inches by 5 inches. On placing some of the contents of the ovary on a piece of glass, and mixing a little seawater with it, a most extraordinary scene presented itself, under a $\frac{1}{4}$ inch power magnifying 500 times. The ova were not nearly so large as those from the Burnham oysters mentioned before: they were of two distinct sizes, and very slightly oval, the larger being about four times the size of the smaller; the smaller were moving about by means of their cilia very actively, while the larger ones were stationary and round, with a slightly darkened margin, as in those from Burnham. The smaller ones came into frequent contact, and adhered to the larger ones, sometimes singly, and at other times in groups; when such was the case they moved, as if tugging at the larger, and in the apparent effort occasionally let go their hold, and, as it were, sprang from the larger; sometimes a small one would come in contact with a large one, without attaching itself. After observing them for about ten minutes, the whole became quiescent. I placed some more of the contents of the ovary under the microscope; but it was far less lively than the first portion observed, probably in consequence of exposure to the air. I have only observed oysters precisely in this state five or six times, as it is scarcely possible out of a large number, even if obtained from the same locality, to find two in similar stages. I did not either observe the rounded bodies, with radiating lines, in those last mentioned. . . . The above extracts will be all that is necessary to introduce here. . . . From them I think that it is perfectly evident that the oyster is ovoviviparous and monœcious. I am aware that it is even now the opinion of some fishermen that they are dioecious; but although I have examined hundreds of both those which are, as it is termed,

black-sick and white-sick, I have never been able to distinguish any difference in the form of the spawn,—the fact being that the spawn is always white until it quits the ovary, and then becomes black. The cause of the exudation of the white is easily accounted for by the ovary being heavily loaded, and the oyster, when disturbed, closing its shell. I have seen both white and black spawn escape into the same basket, from the same causes.

“The Burnham dredging also tends strongly to corroborate this opinion, being quite the end of the spawning season, and there being no white spawn observed, although some were black-sick. I have endeavoured to compute the number of young oysters between the branchiæ of a single old one in the following manner:—Having collected them all with a camel-hair brush, and placed them in strong spirits for twenty-four hours, I dried them on blotting-paper—the spirits having removed the glutinous matter,—then weighed a tenth part of a grain, and counted the number of young in it (2500). The total weight of the whole was 72 grains, which, multiplied by 10, and again by 2500, gives 1,800,000 as the total number of young oysters in one old one. I do not mean to say that this calculation is precisely correct, there probably having been some loss; but, at all events, it is a pretty near approximation.”—*“History of the Oyster.”*

Early in August, 1865, Frank Buckland wrote to the *Times*:—“Just now the oysters at the mouth of the Thames are in full ‘black spat’—that is, they are just ready to send forth the young oysters (technically called ‘spat’)

(e) “It is unfortunate that the same word ‘spat’ should be applied to things so different in their nature, as the eggs and unhatched young of the oyster, contained within the mantle cavity, on the one hand, and

without operating with the oyster-knife, is to place oysters newly dredged in the sun; they will shortly 'gape their shells,' and then, by peeping carefully in between the shells one can see in those which contain spat a mass of mud-like material adhering round the beard of the oyster. If the embryo be nearly ready to be emitted from the parent shell, it much resembles slate pencil in a state of powder; if it be in a less advanced stage of maturity, it is of a white, milk-like colour. It has been stated that from one to two million young oysters are produced from a single parent. I have examined several native oysters of the average size and weight, and never found the highest number of spat to be more than 829,655, and the lowest 276,555. Even with these reduced figures, imagine what an enormous number of young ones must be produced from the parent oysters in a well-stocked laying or oyster bed; and yet the 'fall of spat' for the last five years has been bad—in other words, although the young oysters have been born, something has happened to them, and they have died in their infancy."

the young fixed oysters, on the other; while there is no familiar name for the very important stage of development which lies between these two. 'Brood,' 'fry,' and 'spat' would be very convenient names for the three stages, if 'brood' were not already in use for the smallest of the young fixed oysters. Perhaps the most convenient course will be to use 'fry' for the eggs or embryos which are contained within the mantle cavity of the parent; 'larvæ' for the locomotive stage, and 'spat' for the final condition. In order to become spat, the larva appears invariably to fix itself by one side (almost always the left); and, if the surface is favourable, the extent of the surface of adhesion becomes very considerable, and the oyster is fixed throughout life. But, if the surface of adhesion is small, the oyster, as it increases in size, readily becomes detached and lies free, though motionless, on the bottom."—Professor Huxley, "Oysters and the Oyster Question."

Upon this point Professor Huxley observes :—"It is important to observe, that when oyster fishermen say that there has been no 'fall' of spat in a given season, all that is really implied is that the young fixed oysters have not made their appearance. The fact of the absence of a 'fall of spat' does not justify the conclusion that the oysters have not bred as usual. It is quite possible that just as many eggs have been deposited in the branchial cavity, and that just as many larvæ have been set free as in other years; but that the larvæ have been destroyed by those changes of temperature to which they are so sensitive, or by other causes. But, of course, it is also quite possible that the oysters have been really barren; or that, although the eggs have reached the mantle cavity, the larvæ have not hatched out. Oyster eggs, no less than hens' eggs, may be addled.

"It is obviously useless to speculate upon the causes of a 'failure of spat,' until, by the examination of samples of oysters from time to time, and by sweeping the superjacent water with a fine towing net, the exact nature of the particular case of failure has been ascertained. There is much reason to believe that the fertility of oysters, preserved in parcs, is greatly diminished, although the oysters themselves may be improved in fatness and quality by the process, and that this is especially the case when the water in which they are preserved has a low degree of salinity; and it is very desirable to ascertain the nature of the modifications effected in the structure and functions of the reproductive apparatus of the oyster under those circumstances."

"I have been lucky enough," continues Frank Buckland, "to see more than once, in my little oyster observatory, the process of 'spatting.' The oyster slowly and

cunningly opens its shells and waits awhile. If there is the slightest jar or shake in the water, snap go the shells in an instant, like a steel trap on the leg of a rabbit. All being again quiet, suddenly the parent oyster ejects the spat in a dense cloud, spreading it out in all directions like a jet of steam from a stationary locomotive on a calm day. In a minute or two afterwards out comes another cloud of spat from the oyster, and so on till the performance is concluded."

"If a glass vessel is filled from the stratum of surface water in which the larvæ swim, and held up to the light, it will appear full of minute particles—only $\frac{1}{150}$ th of an inch long, and therefore just visible to the naked eye—which are in active motion. An ordinary hand magnifier is sufficient to show that these minute organisms have very much the aspect of the *Rotifera*, or 'wheel animalcules,' so common in fresh water. They have a glassy transparency, and are colourless, except for one or more dark brown patches; while, at one end, there is a disk, like the 'wheel' of the Rotifers, the margins of which are apparently in rapid motion, and which serve as the organs of propulsion. When this propeller is moderately active, the larvæ dance up and down in the water, with the disk uppermost; but when the action is more rapid, they swim horizontally with the disk forward." (f)

From the observations I have made, I am convinced that in the embryonic state young oysters are very susceptible of cold. If the temperature of the sea suddenly drops many degrees, they all close their shells, and fall to the bottom dead, just as a frosty night will "nip up" and cause to fall off from the branches the delicate blossoms of fruit

trees. If, on the contrary, the weather continues of a warm and equable temperature both day and night, and if it be at the same time calm, the young oysters will have a chance of taking up their positions on the various substances they love best.

In calm and warm weather, and particularly in the sunshine, I find the young oysters like to dance slowly up and down, rising up and falling like sparks from a firework; the main body of them, however, remain at the bottom, swarming about like bees round the entrance of a hive, or a colony of wood ants when their nest is disturbed. (*g*)

“How long the larval oysters remain in this locomotive state, under natural conditions, is unknown, but they may certainly retain their activity for a week, as I have kept them myself in a bottle of sea water, which was neither changed nor aerated, for that period. But, sooner or later, they settle down, fix themselves by one side to any solid body, and rapidly take on the characters of minute oysters, which have the appearance of flattened disks $\frac{1}{20}$ th of an inch, more or less, in diameter; they are therefore perfectly visible, as white dots, on the surface of the substance to which they adhere. In this condition, the name of ‘spat’ is also applied to them. The locomotive larvæ being practically invisible in the sea, this spat appears to be, as it were, precipitated out of the water; and, since great quantities appear at once, the oyster fishermen speak of a ‘fall’ of spat.” “The young oysters grow very rapidly. In five or six months, they attain the size of a threepenny piece; and, by the time they are a twelve-month old, they may reach an inch or more in diameter. The rate of growth varies with the breed of oyster, and with the conditions to which it is exposed; but it is a

roughly accurate and convenient way of putting the matter to say, that at two years the oyster measures two inches across, and at three years, three inches. After this, which may be regarded as the adult age, the growth is much slower, and the shell increases in thickness, much more than in circumference."

The natural term of the oyster's life is not known, but there is reason to believe that it may extend to twenty years or more. An excellent authority, Professor Möbius, is of opinion that most of the adult Schleswig oysters are from seven to ten years old, and that, though oysters over twenty years of age are rare, he has met with occasional specimens which had attained between twenty-five and thirty years.

Oysters breed long before they are full grown, very probably in the first year of their age, certainly in the second. Their productivity appears to reach its maximum at five or six years, and afterwards to decline; but much further observation is needed before any definite rules can be laid down on this subject.

These are the most important obvious phenomena presented by the reproductive processes of the oyster. (*h*) We must now consider them a little more in detail, and under those aspects which are hidden from ordinary observation.

The oyster, like other animals, takes its origin in an egg, or *ovum*, a minute, relatively structureless, protoplasmic spheroidal body, about $\frac{1}{250}$ th of an inch in diameter,

(*h*) It must be remembered that the account here given holds good only of the *Ostrea edulis* of England and Northern Europe. In the Portuguese Oyster (*O. angulata*) and the American Oyster (*O. virginiana*) the eggs are set free at once, and are not incubated in the mantle cavity of the parents.

by a long series of developmental changes which take place in that ovum after it has united with another living particle of extremely minute size, the *spermatozoon*, and in consequence of the fertilisation effected by that union, just as the ovule of a plant develops in consequence of the influence of the pollen upon it. And the first problem is, Where are these ova and spermatozoa formed? Does each oyster produce both, or are they formed in distinct oysters? (i) This is, in fact, the vexed question of the sexes of the oyster, which has been the subject of so much discussion, and for which the answer is gradually shaping itself, thanks mainly to the recent labours of Möbius and Hoek.

I have already stated that if the surface of the trunk of a full-grown oyster is examined carefully with a lens, or

(i) In order to shew the difference of opinion upon this point of the Oyster Question, I quote an extract from an article headed "Oysters: Native and Foreign," by an anonymous writer in "Whitaker's Journal of Amusing and Instructive Literature," (1876.)

"Staid, morose, and uncommunicative as an oyster is, closely secured in his shell armour, the thousand years or more that he has been under cultivation have not served to unfold half the secrets connected with his internal economy and domestic arrangements. To this day, the mode of reproduction in this creature is not definitely ascertained, and it is generally believed that it is 'hermaphrodite,' i.e., that each individual possesses the attributes of both sexes. To this view, the writer is personally opposed; it is more probable that a similar course prevails with these molluscs to that which is known to obtain among fish. The milt of the male salmon, for instance, and the ova of the female are both emitted at the same time, and the latter fecundated by coming into contact, in the water, with the former. Oysters, however, are not oviparous, but viviparous, and the young are emitted from the mother oyster in a perfect state; it is more than probable that impregnation takes place through the agency of milt floating in the water, the structure of the oyster preventing the possibility of any other solution of the difficulty."

even without one, a curious ramified and more or less reticulated whitish marking, which is very obvious in the breeding season, is observable beneath the thin tegument. By appropriate methods of investigation, it is easily determined that this marking is produced by the ramifications of a tubular organ,—the *reproductive gland*,—the trunk of which debouches into a cavity common to it and the renal organs, which again, it will be recollected, communicates by a narrow slit with the supra-branchial chamber. The trunk of the gland, on each side, passes upwards and backwards, in front of and above the adductor muscle, and gives off a multitude of branches, some of which cross the middle line and become inextricably united with those of the other side; while others form a network beneath the skin, which covers the stomach and the liver. From this network, blind offshoots are given off perpendicularly inwards, and extend for a variable depth into the interior of the body. The whole extent of the walls of the tubes of this reproductive gland is lined by nucleated cells, and it is by the metamorphoses of these cells that the ova, on the one hand, and the spermatozoa, on the other, are produced.

During the breeding season, an examination of the adult oysters on an oyster bed shows that the number of individuals, the reproductive glands of which contain hardly anything but ova, is about equal to that of the individuals in which the reproductive gland contains hardly anything but spermatozoa. I say “hardly anything,” because competent observers have affirmed, that careful search will always reveal a few spermatozoa, in the former, and a few ova, in the latter. Whether this be so or not, there can be no doubt that, practically, oysters, while actually breeding, are either males or females.

When the ova or spermatozoa are ripe, they flow out of the reproductive gland into the surrounding water. The spermatozoa are carried away by the exhalant currents of the oyster in which they are developed, and are doubtless drawn in by the inhalant currents of adjacent oysters, the eggs of which they fertilise. And, as the eggs already exhibit the first of that series of changes which lead to the formation of the larva, when they leave the reproductive gland, it would appear that they must undergo fertilization while still within that organ.

The eggs which pass into the supra-branchial chamber must also be driven out by the exhalant current; but it would seem that, when they reach the hinder edge of the branchial partition, they come within the influence of the inhalant current, and are thereby swept back into the infra-branchial chamber. Here they accumulate, and becoming embedded in a viscid albuminous matter, secreted by the parent, constitute the "white" fry.

From the nature of the case, this account of what takes place is not the result of direct observation; but it seems by far the most probable explanation of the facts which can be observed. In an oyster which contains white fry, in fact, the reproductive gland is flaccid, and contains nothing, or hardly anything, but a few unexpelled ova. The case is different, however, with oysters the eggs of which have been laid so long that they have passed into the condition of "black spat." Here many, or, as I have recently found in one case, the great majority of the tubes of the gland contain developing spermatozoa, while only a few exhibit ova. And Dr. Hoek has recently made the important observation that, if an oyster which contains fry is kept for a fortnight in an aquarium by itself, and then

examined, the reproductive organ will be found no longer to contain ova, but abundant developing and fully formed spermatozoa. After producing eggs, in fact, the female oyster changes its sex and becomes male. (*j*)

The conclusion, first advocated by M. Davaine many years ago, that the same individual oyster is alternately male and female, is therefore unquestionably correct. What has yet to be made out is the period of recurrence of this extraordinary alternation of sexes. Do oysters change their sexes once or more than once in a season? Until this point is ascertained, all calculations as to the proportionate number of oysters which breed during a season, based on the observation of the proportion of those which at any given time contain fry, are obviously unsafe. If, for example, the alternation took place once a month, not more than half the oysters might at any time contain fry, and yet, in four months, every oyster might have spat twice.

In the case of the Portuguese and the American oysters, in which both the reproductive products pass at once into the water, and no incubation takes place, artificial fecundation is easily effected. The embryos develop normally, pass through their changes within the egg, and

(*j*) According to Davaine, the oysters are said to produce only male sexual products towards the end of the first year, and it is only later, from the third year onwards, that they become females and produce ova.

Möebius, on the contrary, asserts that the sperm is the later formed, and not until after the pregnant beast has got rid of her eggs. The reproduction takes place especially in the months of June and July, at which time, in spite of their extraordinary fertility, the oysters must not be gathered.—“Text Book of Zoology,” p. 25.—(Claus and Sedgwick.)

their locomotive stage, into the condition of fixed oysters, rapidly, when confined in properly arranged aquaria.

It is probable, therefore, that artificial breeding will sooner or later be practised on a great scale with these oysters. In the case of our own oysters, artificial propagation, by the methods practised in the case of the Portuguese and American forms, which involve the destruction of both parents, is obviously out of the question, unless some substitute can be found for the process of incubation, during which it is probable that the young oysters receive, not merely shelter but nourishment, from the parent. But a careful study of the conditions under which our oysters breed freely, will no doubt enable oyster cultivators to imitate these conditions, and to place their breeding stock under circumstances in which hurtful influences shall be excluded; while the larvæ are prevented from wandering too far, and facilities are afforded for their attachment. The oyster grounds at the mouth of the Scheldt, of which a very interesting account was given by Dr. Hubrecht, at one of the conferences of the International Fishery Exhibition, (*k*) seem to be in a fair way of realising these conditions. (*l*)

I am afraid the reader will deem me somewhat tedious in having already lingered, perhaps, a little too long upon this chapter of my book, and he or she may possibly resent the unsolicited (but not, I hope, unwelcome) introduction of "another" eminent naturalist, whose "difference of opinion" I respectfully intrude upon his or her time and patience, with the aim of arousing the interest of either.

(*k*) Papers of the Conferences. "Oyster Culture and Oyster Fisheries in the Netherlands," by Professor Hubrecht.

(*l*) "Oysters and the Oyster Question."—Professor Huxley.

But, after all, taking into consideration the universal interest in the Oyster Question, together with the fact that—in support of the hitherto attainable knowledge necessary for the protection and productive cultivation of this delicious phosphate;—"difference of opinion" from competent scientists (although retracing the same ground) can only serve to expand our narrow views, illumine our ignorance, and sharpen our intellectual faculties; and, I think, that, taken in this light, no apology is needed, or that the reader will demand one, for my purpose mentioned; or that I shall be accused of "unnecessary repetition," relative to the larvæ of the oyster, in quoting from Mr. James G. Bertram's "Harvest of the Sea," wherein (p. 234), alluding to the spawn of the oyster, that able and entertaining writer says:—"My 'theory' is that the parent oyster goes on *brewing* its spawn for some time—I have seen it oozing from the same animal for some days—and it is supposed that the spawn swims about with the current for a short period before it falls, being in the meantime devoured by countless sea animals of all kinds. The operation of nursing, brewing, and exuding the spat from the parental shell will occupy a considerable period—say from two to four weeks. . . . On occasions of visiting the beds, I have seen the dredge covered with spawn, and no pen could number the thousands of millions of oysters thus prevented from ripening into life. Economists ought to note this fact with respect to fish generally, for the enormous destruction of spawn of all kinds must exercise a very serious influence on our fish supplies. I may also note that the state of the weather has a serious influence on the spawn and on the adult oyster-power of spawning. A cold season is very unfavourable, and a decidedly cold day will kill the spat."

“One sees occasionally,” says Frank Buckland (*Times*, August, 1865,) “columns of gnats dancing up and down in the air. I fancy the same conditions which suit the gnats on land suit the young oysters in the sea. Cold and wind disperse the gnats, and they are no more seen; the same with the oysters, though they have many enemies besides.”

The following theory of the spat was promulgated by Mr. Bertram, through the columns of the *Times*:—(*m*) “In an open expanse of sea the spat may be carried to great distances by tidal influence, or a sharp breeze upon the water may waft the oyster-seed many a long mile away. Every bed has its own time of spatting—thus, one of a series of scalps may be spatting on a fine warm day, when the sea is like glass, so that the spat cannot fail to fall; while on another portion of the beds the spat may fall on a windy day, be thus left to the tender mercy of a fiercely receding tide, and so be lost, or fall mayhap on an ungenial bottom, a long way from the shore.

“On the Isle of Oleron, which supplies the green oyster breeders of Marennes with such large quantities, it is quite certain that in the course of the summer a friendly wave will waft large quantities of spat into the artificial parcs, when it is known that the oysters in these parcs have not spawned. Where does the spat come from? The men say it comes off some of the natural beds of the adjoining sea—is driven in by the tide, and finds a welcome resting-place on the artificial receivers of their parcs. It is altogether an erroneous idea to suppose that there are some seasons when the oyster does not spat, because of the cold weather, &c. Some of the parcs had spat at Arcachon this year (1866), in very ungenial weather. The

(*m*) No date given; see “Harvest of the Sea,” p. 253.

spatting of the oyster does not depend on the weather at all, but the destination of the spat does, because, if the tiny seedling oyster does not fall on propitious ground, it is lost for ever. New oyster beds are often discovered in places where it is certain oysters did not exist in previous years. How came they then to be formed? The spat must have been blown upon that ground by the ill wind that carried it away from the spot where it was expected to fall. If the spat exuded by the large quantity of oysters known to be stocked in the parcs at Whitstable, in Kent, the home of the 'native,' were always to fall on the cultch of Whitstable, instead of on the adjoining flats and elsewhere, the company would soon become enormously rich.'

In the "Year Book of Facts," for 1866, under "The Oyster Crop of 1865," will be found the following interesting information:—"Mr. Buckland, we perceive, states that the fisheries depend upon 'the natural fall of spat,' which is controverted by Mr. Cholmondeley Pennel, who contends that the principle on which they are worked is briefly this: 'There are hundreds of oyster grounds in all parts of the kingdom which will, and do, constantly breed oysters; the speciality of the Thames beds is to fatten them. Oysters bred in Ireland, for instance, with a few exceptions, are rough, coarse-flavoured, and in many instances actually unpalatable, from saltiness or muddiness, or both. These cheap, rough oysters, are brought over and laid down at Whitstable or Herne Bay, and in a few months they become palatable and fat, and ultimately realize a high price at Billingsgate; and if they 'spat' on the ground before being sent to market, the quality of the Thames water is such that in two or three generations at furthest their progeny become, to all intents and purposes, pure natives. Again, brood oysters are procured in large

quantities from Wales, Falmouth, and the coasts of Kent and Essex. These latter, when arrived at maturity, are in all respects equal to the produce of either of the great fisheries, and constitute the larger proportion of the exquisite 'native oysters' so familiar at the dinner-tables of London and Paris. The Thames oyster fisheries are, in short, the finest fattening grounds in the world. This is the secret of their extraordinary prosperity, and on this basis primarily they are worked.

"It happens, however, that besides this, there occurs every now and then an unusually heavy fall of spat (there was always a certain quantity) on the Thames beds themselves and their neighbourhood, and this is of course a god-send to the oyster companies, as it is sometimes worth hundreds of thousands of pounds. But it is now seven years, or thereabout, since they had such a golden shower, and, for aught they can tell, it may be seven years more before they have another."

"Some people," says Mr. Bertram, (n) "have asserted that the oyster can reproduce its kind in twenty weeks, and that in ten months it is full grown. Both of these assertions are pure nonsense. At the age of three months an oyster is not much bigger than a pea, and the age at which reproduction begins has never been accurately ascertained, but it is thought to be three years. . . . Oysters are usually four years old before they are sent to the London market. At the age of five years the oyster is, I think, in its prime, and some of our most intelligent fishermen think its average duration of life to be ten years.

"In these days of oyster-farming, the time at which the

(n) "The Harvest of the Sea," p. 234.

oyster becomes reproductive may be easily fixed, and it will no doubt be found to vary in different localities. At some places it becomes saleable—chiefly, however, for fattening—in the course of two years; at other places, it is three or four years before it becomes a saleable commodity; but on the average, it will be quite safe to assume that at four years the oyster is both ripe for sale and able for the reproduction of its kind.*

“Let us hope that the breeders will take care to have at least one brood from each batch before they offer any for sale. Oyster farmers should keep before them the folly of the salmon-fishers, who kill their grilse—*i.e.*, the virgin fish—before they have an opportunity of perpetuating their race.

“When the free larva of the oyster settles down into the fixed state, the left lobe of the mantle stretches beyond its valve, and applying itself to the surface of the stone or shell to which the valve is to adhere, secretes shelly matter, which serves to cement the valve to its support. As the animal grows, the mantle deposits new layers of shell over its whole surface, so that the larval shell-valves become separated from the mantle by the new layers which crop out beyond their margins, and acquire the characteristic prismatic and nacreous structure. The summits of the outer faces of the umbones thus correspond with the places of the larval valves, which soon cease to be discernible. After a time, the body becomes convex on the left side and flat on the right; the successively added new

* S. P. Woodward in his “Manual of Mollusca,” asserts that oysters reared in artificial grounds do not attain their full growth in less than five or seven years, whilst the sea oysters, namely those found in natural oyster beds, which usually occur in water several fathoms deep, are full grown in four years. p. 254.

layers of shell mould themselves upon it ; and the animal acquires the asymmetry characteristic of the adult.

“ Oysters are gregarious, in consequence of the vast multitude of locomotive larvæ which are set free simultaneously ; and which, being subjected to the same influences, tend to settle about the same time in the area to which the swarm drifts. Millions of oysters are thus aggregated together over stretches of the bottom of the sea, at depths of from one or two to twenty or more fathoms, and constitute what are known as oyster beds.

“ Although oysters live and grow well enough in estuaries, in which the salinity of the water undergoes large variations, according to the state of the tide and the volume of fresh water that is poured in, yet they do not flourish permanently and breed freely in water with less than 3 per cent. of saline constituents. Thus the Baltic is, at present, unfit for their support, and the east coast of Schleswig, washed by its brackish waters, is devoid of oysters, while certain parts of the west coast are famous for their oyster beds. Gravel, stones, and dead shell—commonly known as ‘cultch’—form the most favourable bottom, as they facilitate the attachment of the young. Disturbed muddy bottoms, on the other hand, are fatal because turbid water, laden with coarse sediment and entering the infra-brachial cavity, particles of mud, too large to be moved by the cilia, lodge upon the gills, and, gradually obstructing the current, interfere with the primary functions of feeding and breathing to such an extent as to injure, or even to destroy the animal. But it is a curious fact, that even where a large extent of sea-bottom presents apparently the same conditions, oyster beds occur in some localities and not in others.” (o)

(o) “ Oysters and the Oyster Question.”—Professor T. H. Huxley.

It is often enough the case that the spawn falls at a considerable distance from the place where it has been emitted. Thus the spawn from the Whitstable and Faversham Oyster Companies' beds—and these contain millions of oysters in various stages of progress—falls usually on a large piece of ground between Whitstable and the Isle of Thanet, formerly common property, but, some years since, *given* by Act of Parliament to a company formed for the breeding of oysters.

It is thought that not more than one oyster out of each million arrives at maturity. It is curious to note that some oysters have immense shells, with very little "meat" in them. I recently saw in a restaurant several oysters, much larger externally than crown-pieces, with the "meat" about the size of a sixpence: these were Firth of Forth oysters from Cockenzie. It is not easy to determine, from the external size of the animal, the amount of "meat" it will yield—apparently, "the bigger the oyster the smaller the meat." In the early part of the season only very small oysters are sold in Edinburgh—the reason assigned being that all the best dredgers are "away at the herring," and that the persons left behind at the oyster beds are only able to skim them; so that, for a period of about six weeks, we merely obtain the small fry that are lying on the top. It is quite certain that as the season advances the oysters obtained are larger and of more decided flavour. In the "natives" obtained at Whitstable the shell and the meat are pretty much in keeping as to size, and this is an advantage. (*p*)

The writer of the Article in *Whitaker's Journal*, already quoted from, says:—"I have measured the shell of a red-

coloured, coarse, scaly oyster from Portugal, eleven inches in length and five and a half in width ; beneath such a mass of armour one would expect to find a precious treasure ; but, far less than a pearl, it contained hardly any meat, and a periwinkle would be a good mouthful—and far superior in flavour—compared with the ‘oyster’ inside. Similar oysters, laid down when young on suitable beds, would develop into something more attractive looking, and certainly more delicate ; and millions of oysters are annually imported into this country and laid down in selected localities, in order to improve their condition ; and, like charity children removed into better quarters and fed on the fat of the land, they rapidly put on flesh. But just as there are some charity children who never do credit to their keeper, and persist in remaining scraggy, so there are some oysters that refuse to fatten up, and which it is no use to attempt to cultivate. Whether later generations, born and bred amid civilization, would turn out any better, is a problem which such institutions as the Brighton Aquarium may solve. There are, indeed, many points connected with the oyster which require elucidation, and on which we might possibly gain information by means of careful experiments in aquaria, such as the temperature best suited to its growth, and the development of the spat, the manner and frequency of breeding, the mode of adhesion, &c., &c.”

It is generally believed that water of a high temperature, from 60° to 70°, is necessary to the well-being of the spat during its infancy, and some naturalists are of opinion that the parent oysters will not breed unless the water is sufficiently warm. It is certain that cold is fatal to oysters, and equally so is extreme heat. For this reason the owners of oyster breeding establishments encourage a moderate

growth of the weed called *zostera marina*, which affords a shelter to the stock when placed in the comparatively shallow beds, during the summer months.

Elaborate preparations are made at the principal oyster breeding establishments, both in England and abroad, to ensure the successful adhesion of the spat, and for its subsequent fattening for the market. Various improvements have been made in the material employed as "cultch" or "collectors" for the infant population. From bundles of wood to stones, from stones to empty shells, from shells to specially made tiles, advances have been made, till perfection is believed to have been attained in the adoption of tiles, made in a V-form, inverted, and coated with a thin layer of lime and sand, on which the young spat adhere, and from which they can be detached by chipping off the said mixture, and preventing injury to the shell or the destruction of the tile. Formerly, great loss was experienced in the removal of the crop of oysters from the collectors, but by the above method the risk of injury is reduced to a minimum. When removed, they are placed in special beds, to which the access of the tide is regulated by means of hatches and sluices, and from which enemies are excluded by ingeniously contrived traps. "Nurseries" are established for the weakly population, "ambulances" for the wounded; while special quarters are set apart for those that have done their duty, and grown fat for the delectation of man.

Alluding to the long list of influences against which every oyster has to struggle successfully, if it is to attain maturity, with a perhaps too true inference that "larger knowledge will doubtless add many others," Professor Huxley says very truly that "these are enough

to enable us to understand why it is that the increase of a given stock of oysters may be, and usually is, very slight, notwithstanding the prodigious fertility of the individual oyster. A very large proportion of the oysters in a bed, under ordinary circumstances, breed during the season; and as each adult female oyster, on an average, gives rise to a million eggs, one would expect a prodigious increase, even if nine-tenths of the young were destroyed. But from the small proportion of half-grown to full-grown oysters (40-50 per cent.), it is clear that the real addition to the oyster population, in most years, is very small. It is probable, in fact, that unless the conditions are unusually favourable, not more than two or three out of every million of the fry of the oyster ever reach maturity.

“It is obvious that the conditions of existence of the oyster are of an extremely complicated character, and that the population of an oyster bed, under natural conditions, must be subject to great fluctuations. A few good spatting years, accompanied by a falling-off in the number of starfishes and dogwhelks (*g*), may increase it marvellously, while the contrary conditions may as strikingly reduce it.” (*r*)

A great amount of the miscellaneous information regarding oyster-growth and oyster-commerce, which was circulated a few years since (and the remark applies almost as much to the present time), is not of a reliable nature; but many of the circumstances attendant on artificial culture are interesting, and have been proved to be correct, although they seem contradictory: as, for instance, that

(*g*) In the Bay of Arcachon, 14,000 whelk tangles were picked off 100 acres of oyster ground in the course of a month.

(*r*) “Oysters and the Oyster Question.”

oysters if spawned on a muddy bottom are lost, although the same muddy bottom is highly suitable for the feeding stages of the mollusc. It is also remarkable that breeding oysters do not fatten, and that fat oysters yield no *spat*. There has been some controversy as to whether transplanted oysters will breed; opinions differ, and it is on record that such a remarkable spat once fell on the Whitstable grounds as to provide a stock for eleven years, including, of course, what was gathered towards the end of that period.

A close time for oysters is a law of the land; but for all that we might have—indeed, we have now—oysters all the year round, because all oysters do not sicken or *spat* at the same period; in fact, the economy of fish growth is not yet understood either by naturalists or fishermen; as an instance of mal-economy we have salmon rivers closed at the very time they ought to be open, some rivers being remarkable for early spawning fish, whilst others are equally so for the tardiness with which their scaly inhabitants repeat the story of their birth. In time, when we understand better how to manage our fisheries, the supplies of all kinds of round and shell fish will doubtless be better regulated than at present. (s) And although, since that was written (as Mr. Bertram, in his Preface, assures us), “much in our fishery economy that was wrong has been made right,” I do not, I am sure, exaggerate the fact that there is still room left for improvement, as far as the Oyster Fisheries are concerned. Oysters (as already mentioned) are found in almost all countries, but not always of the same species as the British one, *Ostrea edulis*.

The following is a list of the Oysters belonging to the genus *Ostrea*, given in Hanley's "Illustrated Catalogue of Recent Bivalve Shells:"—

<i>Ostrea edulis</i>	British Isles ; France.
—— <i>hippopus</i>	Boulogne.
—— <i>adriatica</i>	Adriatic ; Black Sea.
—— <i>cochlear</i>	Mediterranean.
—— <i>cristata</i>	Mediterranean.
—— <i>gallina</i>	Atlantic.
—— <i>lingua</i>	Timor.
—— <i>tulipa</i>	Habitat unknown.
—— <i>scabra</i>	America.
—— <i>parasitica</i>	West Indies.
—— <i>denticulata</i>	China.
—— <i>spatulata</i>	On mangrove trees.
—— <i>virginica</i>	Virginia ; Mexico.
—— <i>canadensis</i>	North America.
—— <i>excavata</i>	New Holland.
—— <i>mytiloides</i>	Zebu ; Philippines.
—— <i>sinuata</i>	Australia.
—— <i>trapezina</i>	New Holland.
—— <i>rufa</i>	America.
—— <i>margaritacea</i>	South America.
—— <i>gibbosa</i>	Habitat unknown.
—— <i>elliptica</i>	Habitat unknown.
—— <i>angulata</i>	Tagus (<i>Gryphæa</i>)
—— <i>echinata</i>	Philippines ; Amboyna.
—— <i>stellata</i>	Guinea.
—— <i>prismatica</i>	Guacomayo, Central America.
—— <i>lamellosa</i>	Mediterranean.
—— <i>uncinata</i>	Greece ; Smyrna.
—— <i>raricosta</i>	Habitat unknown.
—— <i>senegalensis</i>	Senegal.
—— <i>orientalis</i>	East Indies.
—— <i>rosacea</i>	China ; Senegal.
—— <i>Chemnitzii</i>	China.
—— <i>turbinata</i>	Indian Ocean.

—— columbiensis	West Columbia,
—— lacerans	Senegal.
—— bicolor	Senegal.
—— multistriata	On ships' bottoms, from Africa.
—— callichroa	China.
—— glaucina	Habitat unknown.
—— sinensis	China.
—— crista galli	Indian Ocean.
—— hyotis	Indian Seas.
—— radiata	Indian Ocean.
—— megadon	Peru.
—— pes tigris	Java.
—— Lincolnii	Australia.
—— pyxidata	Philippines.



CHAPTER VIII.

VARIETIES OF OYSTERS.

MARINE.

CLASS CONCHIFERA. (CUVIER.)

ORDER LAMELLIBRANCHIATA. (DE BLAINVILLE.)

INTRODUCTORY REMARKS RELATIVE TO THE BRACHIOPODA AND
THE LAMELLIBRANCHIATA—GENUS ANOMIA—ANOMIA EPHIPIUM—
ANOMIA PATELLIFORMIS—OSTREIDÆ—GENUS OSTREA—
OSTREA EDULIS.

“ Oh ! what an endlesse worke have I in hand,
To count the sea’s abundant progeny,
Whose fruitful seed farre passeth those in land,
And also those which wonne in the azure sky ;
And much more earth to tell the starres on hy,
Albe they endlesse seeme in estimation,
Than to recount the sea’s posterity,
So fertile be the floods in generation,
So huge their numbers, and so numberlesse their nation.”

SPENSER.

THERE are two classes of soft-bodied animals which secrete a hard chalky substance in the form of two hollow-

saucer-shaped pieces, that fit more or less closely together along their edges, and which, therefore, when drawn together, can completely protect the animal, that lies wholly between them, from all injury.

These are called bivalve molluscs. The shells are usually so united at one point in their circumferences as to play upon that point as a hinge, while the remainder of the two shells can be separated so as to gape more or less widely on the side opposite the hinge. In this manner the creatures can keep open house when their guests are likely to be those upon which they can prey, and can shut their folding doors when they are themselves likely to be victimised.

These shells are usually thick and heavy, especially in those species which are marine, for the wear and tear of the sea is greater, and the predatory creatures more powerful than those in fresh water. Moreover the box or house must be tolerably capacious, otherwise the creatures could not breathe while they were in a state of siege, and must surrender at discretion to the expectant lobster or other freebooters of the deep. It follows that this arrangement is not well suited to locomotion; and not being locomotive to any great degree, they are not endowed with those perfect organs of sense that must be possessed by those animals which chase their prey. When organs of sense are possessed, they are usually collected on a protruded part of the body, and placed above the mouth, which opens at the front part. Such a projection, which supports the eyes, feelers, ears, and smelling capsules, and contains a nervous centre conveniently and closely situated to these gateways of knowledge, is usually called a head.

Now these bivalve molluscs are distinguished from the

higher orders in having no heads, and are called acephalous. They have mouths, and a nerve-knot above this; but the mouth is not prominent, and lies far within the shelly box, and often between the soft projections of the body, which extend some distance beyond it. Their organs of sense are also very poor and imperfect; and when they are possessed at all, they are placed in other parts of the body. There are two classes, viz: Brachiopoda and Conchifera, which together compose this group of headless, two-shelled Mollusca, and which are extremely different in structure throughout. There is, however, an external difference by which they may be distinguished by a superficial observation.

In the Brachiopods the shells are secreted on extensions of the membrane of the body on the *back* and *front* of the animals; while in the Conchifera the shells are placed upon membranes which are developed from the *sides* of the animal. Thus, if both animals were split down the middle by a cutting instrument, which should leave the divided halves more or less alike, that instrument would pass through both shells of the Brachiopods, dividing them both into two equal parts, while it would not cut the shells of the Conchifera at all, but only sever them the one from the other. So that in this arrangement of the animal to the shell, the separating process would leave two absolutely similar halves. On the other hand, the division of the Brachiopod, so as to sever the shells, would leave two portions unlike both in size and form. A similar partition of the conchiferous shell would leave two equal and similar parts.

It should, however, be remarked that the ordinary position occupied by both classes of bivalves, resting as they do on the bottom of the sea, sometimes interferes

with the bilateral symmetry of the Conchifers, while it leaves that of the Brachiopods untouched.

In the Brachiopods the double shell is flattened as if the back and front of the animal had been squeezed together, and this kind of flattening is technically called *depression*.

In Conchifera, the double shell is usually flattened as though the creatures had been squeezed by pressure applied to its sides, and this flattening is called, in the language of Comparative Anatomy, *compression*.

Now, as these passive creatures, whether fixed or free, usually rest on the floor of the sea, it follows that they must lie, not on the edges, but on the flats of their shells ; and when thus lying, they rest habitually on one shell, and this shell is often so modified in relation to the other as to suit the lying posture.

The Brachiopods rest on their ventral shell, with the back or dorsal shell uppermost, and therefore this modification does not interfere with the symmetry or equality of the two halves ; but it *does* interfere with the symmetry of the Conchifera, because they rest on their sides. A similar instance of this effect of habit on the two-sided arrangement of the body is seen in the soles, turbot, &c., which constitute the family of fishes called Pleuronectidæ, as contrasted with the equally flat rays. The depressed rays, lying with their backs uppermost, are quite symmetrical ; while the soles, resting on their sides, are quite distorted in shape, and the two sides differ in colour.

Notwithstanding this tendency to one-sidedness in the Conchifera due to habit, most of them have nearly equal valves ; and in none is the internal arrangement of organs much interfered with. (a)

(a) "Cassell's Popular Educator."

Having thus drawn attention to the superficial contrast between the classes, I proceed to describe the Brachiopoda, which are far inferior to the Conchifera, and bear a stronger relation to the Tunicata and Polyzoa than they do to the other class under our notice.

BRACHIOPODA.

GENERAL CHARACTERS.—The animals of this class are distinguished from the Lamellibranchiate *Mollusca* by the absence of any special branchial apparatus, the respiratory function being performed by the mantle, which is traversed by numerous blood-vessels. They are also characterized by the possession of a pair of long, ciliated, and usually spiral arms, the analogues of the labial tentacles of the ordinary bivalves. The action of the cilia with which these are clothed produces a current in the water, that carries the particles of food to the mouth, which is situated close to their base. From the presence of these organs the class receives the term Brachiopoda.

The same class is also known by the term Palliobranchiata. The valves, instead of being placed on each side of the body of the animal, are situated above and below it; so that they are called *dorsal* and *ventral*, instead of *right* and *left*, valves. The ventral valve is usually larger than the dorsal, and projects beyond it at the beak, where it is generally perforated to allow the passage of a muscular or tendinous peduncle, by which the animal attaches itself.

In some cases the peduncle is wanting, and the shell is then fixed by the beak. The connexion of the valves is effected by a pair of teeth, springing from the ventral valve, and locking into corresponding cavities in the dorsal valve. There is no ligament, and the valves of the shell are opened and closed by appropriate muscles.

The arms are frequently supported upon a calcareous framework or skeleton, attached to the interior of the dorsal valve ; this usually forms two loops, springing from the neighbourhood of the hinge. The arms appear to be extensible in some instances ; but in others they are attached to the internal framework, and only the extremity is free.

The body of the animal only occupies a small portion of the cavity of the shell close to the hinge ; it is enclosed within a strong membranous partition, in the centre of which the mouth is seen. The intestine is convoluted, and the liver is large and granular.

All the Brachiopoda appear to possess two hearts, each composed of an auricle and a ventricle, situated in the neighbourhood of the oesophagus ; they are also furnished with a complex system of vessels, which conveys the blood to the organs of the body, and to the mantle, where it is exposed to the influence of the water.

The structure of the shell is very peculiar. It consists of flattened prismatic cells, arranged in an oblique direction as regards the surfaces of the shell ; the substance of the shell is traversed by small canals, through which little processes of the outer layer of the mantle pass.

These animals are all marine ; they are found attached by the peduncle, which passes through the aperture in the ventral valve, suspended from rocks, corals, and other submarine objects. The fossil species are exceedingly numerous, especially in the older strata, in some of which they are the principal representatives of the Molluscan type of structure.

THE CONCHIFERA.

The Conchifera are mainly characterised by their breathing organs. They have no fringed arms stretching away from the sides of their mouth ; and their mantle not being sufficiently effective as an organ of respiration, they have, developed from the body, and lying between the mantle-lined shells and the body mass, two sheets of membrane on each side. The relation of these breathing plates is best seen in an illustration, where there is a section given of the animal as it would appear if it were cut across so as to divide both shells. These gill-plates secure that the blood shall be well aërated, not only by exposing as large an amount of surface as possible, but also by having gill-tubes, which run through the plates from one edge to the other, through which the water passes. As is usually the case with breathing surfaces in marine animals, the plates are covered with cilia, whose motion secures a constant change in the water. The gill-plates are very variously modified in the different families of Lamellibranchiata ; but they are constant throughout the class.

In some, as the oyster, the mantle simply lines the shells and ends at their edges, so that the water has free entrance from all sides. In other families the mantle of one side passes across the aperture of the shell to be united at certain points, or along almost its whole length, to the mantle of the opposite shell. In others the animal is not only almost entirely walled in by the union of the two lobes of the mantle, but part of this mantle is drawn out into two long tubes, one of which communicates with the chamber in which the gills lie, and the other with the smaller lined chamber into which the anus opens, and into which, also, the gill-tubes discharge the water.

This last arrangement is carried to an extreme in those species which burrow and live in holes of the rock or mud of the sea-bottom. The only communication which these have with the outer world is by means of their extended tubes or *siphons*, as they are called. In their case the two tubes are united into one sheath, although a partition passing down the double tube always keeps them functionally distinct. In these creatures the action of the cilia drives the water in one continuous stream from the gill chamber to the ærial chamber through the tubes; and this motion necessitates a flow down one tube and up another. By this means floating food is passed along the gills to the mouth, which is situated at the lower end of the buried molluscs, and thus we have a similar mode of life to that of the tunicates, though the breathing apparatus is of a different structure.

The mantle being thus relieved from the duty of exposing the blood to the oxygen dissolved in the water, is wholly employed in its proper function of secreting the shell. It performs this office in a very efficient manner, so as always to allow for the growth of the animal and for the strengthening of the shell as the contained animal becomes more weighty, and therefore liable to experience more violent collisions.

The method of secretion is the following:—Round the edge of the mantle lobes, or at that part where they leave the shells, are situated a great number of glands, whence secretions of different substances are poured out and mingled together. These glands secrete horny matter, a large quantity of carbonate of lime, and some pigment. Thus a fresh rim of hard matter is added at intervals to the shell. The size, shape, markings, and

colours of the shell are all determined by the edges of this mantle ; and the whole of these characters differ so greatly in the different species, and the result is so beautiful in many, that a collection of shells is very interesting.

The nucleus, or starting point from which the formation of the shell proceeds, is called the umbo ; and the manner in which the additions are made is very various. Sometimes the mantle edge secretes a great deal of matter at one time of the year, and is nearly inactive, or only pours out a thin secretion, at another ; and this will produce a shell with ridges and furrows parallel to the edges of the shell, which are called *sulci*.

If the mantle secretes at certain points, in larger quantity, and but little between these points, or if it be folded or puckered, and the folds remain so during the whole of the growth, then ridges and channels are formed, stretching continuously from umbo to margin. If the margin of the mantle is much folded and thrust out during secretion, it sometimes results in long points or projections, which reach far beyond the rest of the outside of the shell.

In the same way it will be seen that the lining and colouring of the shell into patterns may be effected by the partial and intermittent secretion of colouring matter. The shell, while it is being extended, is also thickened by a thin secretion poured out all over the external surface of the mantle, and therefore all over the internal surface of the shell. This latter secretion is always smooth and colourless, or with only a faint unvariegated pink or purple tint.

. The two valves of the shell are united by the mantle, and at or near the umbo of each valve there is a hinge surface upon which the valves open. This hinge has often a complex system of teeth, which, while they

allow the valves to gape, will not permit them to be shifted or wrenched aside on one another.

Very powerful muscles run directly from shell to shell, and can, when contracted, hold them together with such force that it is impossible to open them without the assistance of an oyster-knife; and as none of the natural enemies of the molluscs, except man, possess oyster-knives, they are tolerably safe from this kind of forcible entry upon their fortresses.

In most Lamellibranchs there are two muscles to close the valves, one in front and the other behind; but in the oyster family there is but one, and this is near the centre of the shell, and represents the hind muscle of the others.

Opposed to these muscles is the ligament which runs from shell to shell on the outside of some species, and lies in a pit in the hinge surface in others. These ligaments have no power of active contraction as the muscles have, but are passively elastic. In the case of the external ligament, it is in a state of strain when the valves are closed, and opens them when the muscles relax; while in the case of the internal ligament, it is compressed when the muscles are contracted, and presses the valves apart when they relax.

The mouth is without hard teeth or jaws, but it often has large flattened lips. The throat is short, and leads into a roundish stomach, which receives the biliary ducts. The great peculiarity of the stomach is the long blind sac which is attached to it, in which is enclosed a cartilaginous rod, the function of which is not known. The intestine twists about in several folds, entering the foot in those bivalves which have feet, and always ending at the oppo-

site side to the mouth and in the aërial chamber. Singularly enough, in many species the intestine passes directly through the heart a little in front of the anus.

The foot is an organ of very various development and very various functions, in the different species. In some its main office seems to be the secretion of threads, by which the creatures moor themselves to rocks. These threads are formed in a groove in the foot, and one end of the thread, while yet viscid, sticky, and unconsolidated, is applied by the foot to the rock. To this it adheres ; and when the foot is pulled back, the thread is pulled out of its groove and a fresh one made, so that, at length, a bundle of very strong threads passes from the support to the base of the foot. In other cases, as in the solen, the foot is large and broad, and passes out in front of the long razor-like shell by a slit in the mantle, and with this foot the creature burrows in the sand.

In the cockle the foot is long, and can be thrust out and applied to the earth, so as to jerk the animal along. In other species it is little else than a muscular investment of the viscera.

The heart is always *systemic*, that is, it drives the blood, not to the respiratory organs, but to the system, leaving it to return unaided by mechanical force to the gills, and from thence to the heart again. In all species the heart shows a higher development than in the mollusca hitherto treated of, inasmuch as there are always two compartments, one less muscular, to receive the blood, and the other more so, to drive it through a system of vessels, where its course is impeded by their elastic walls. In some species there are two auricles or receivers, and in some very wide Conchifers there are two distinct hearts,

each with its receiving and distributing chambers, or auricle and ventricle as they are respectively called.—(*Cassell's Popular Educator.*)

The Order of the Lamellibranchiata is divided into two unequal groups, distinguished from one another by the number of the adductor muscles.

(1). The *Monomyaria*, having one muscle, placed nearly in the middle, or rather towards the back.

(2). The *Dimyaria*, having a separate muscle placed right and left side of the body. The impressions or scars made by these muscles, on the inside of the shell, serve to instruct the geologist as to which group every bivalve belongs. Some of the members (*e.g.*, certain species of *Lucina*, *Tellina* and *Thracia*,) are said to have only one branchial leaflet or gill on either side the body, but in all probability this leaflet is double, although united and apparently single.

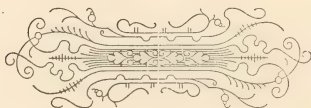
The British *Monomyarian Mollusca* comprise the families Anomiidæ, Ostreidæ, and Pectinidæ; all the remaining families are Dimyarian—which is a very large group. The late Mr. Clarke says that the only true Monomyarian Mollusca are *Pholas* and *Teredo*: other conchologists do not agree with him. Dr. Jeffries does not attach much importance to the form or presence of the pallial scar, being the mark left on the inner margin of the shell by that part of the mantle which adheres to it, and keeps the rest of the body in its proper place; although this character may serve to recognise certain genera.

In some families the mantle is open on all sides but the back for the admission of food and water, as well as for the ejection of fæcal matter; while in others it is

more or less closed in front, or only open in that part for the passage of the foot. In the latter case, the mantle on one or either side is folded, so as to form a single or double tube. This takes place usually on the posterior side, where the shell is broadest; but in a few instances (as in the *Kelliidæ*) the incurrent or alimentary tube is placed on the anterior side, and the current or anal tube on the posterior side. The tubes are of various lengths, and when they do not project beyond the edges of the shell, they are called "*sessile*." The excretory organ is always situated on the upper part of the posterior side. That by which the animal takes in its nourishment, and which supplies the *gills* with aërated water, is usually on the same side, but below the other opening. The excretory opening or tube is the smaller of the two.

REPRODUCTIVE SYSTEM OF THE LAMELLIBRANCHIATA.

It has always been an unsettled question whether any (or which of them) have separate sexes. Lovén is positive that such is the case in the *Modiola*, the Embryogeny of which he has investigated with his usual care. And Sars assures us that *AXINUS* is unquestionably also diœcious.



Mantle open and without tubes.

Family I. ANOMIIDÆ (Anomiadæ), Gray.

BODY roundish: *mantle* having very thin edges, which are furnished with fine and extensile tentacular filaments: *gills* circular and double: *foot* small: *muscle* divided into two or three parts, the largest of which passes through a hole in the hinder part of the lower valve, serving for attachment to extraneous bodies, and forming on them a fibrous or horny plug.

SHELL generally circular and flat, more or less inequivalve: *orifice* pear-shaped, being interrupted by a narrow slit: *cartilage* internal, short, placed somewhat obliquely below the beak.

This family is connected with the *Ostreidæ* by the genus *Pododesmus* of Philippi. Dr. Leach proposed to raise it to the rank of an Order, which he called Trimya.

Genus Anómia.—Linné.

BODY compressed.

SHELL inequilateral, of an irregular shape, dependent on that of the substances to which it is attached: *upper valve* rather convex and thick: *lower valve* flat and thin: *hinge* toothless.

Fabius Colonna, the originator of this name, applied it to species of *Terebratula*. About a century and a half afterwards Linné used it in the same sense, for he described the animal as having two arms, and the shell as furnished with two bony processes or radii, the deeper valve being often perforated at the base. But he included in the genus many species which we now recognise as belonging to

Anomia thus restricted, and long custom has sanctioned the modern use of the word. Poli proposed the name of *Echion* for the animal of the present genus.

According to Dr. Carpenter, the outer layer of the shell has a prismatic cellular structure, and in this respect it appears to resemble the shell of the *Argiope*. There is no visible trace of an epidermis. The plug of attachment is secreted by that part of the adductor muscle which passes through the lower valve. It is not shelly. The fry are fixed in the same way as the adult, soon after their exclusion from the ovary: although it would appear that they enjoy in the meantime a short period of liberty, like their relative the oyster. The *Anomiæ* are popularly designated in this country "silver-shells." In the State of New York they are called "jingle-shells." Dr. Otto Torell informs me that no species has been found north of Iceland; but fossil shells are not uncommon at Uddevalla, in the same bed which contains *Terebratella Spitzbergensis*, *Piliscus commodus*, and other forms of an extremely arctic kind.

1. ANOMIA EPHIPIUM. Linné.

A. Ehippium, Linnæus. Syst. Nat., p. 1150; Forbes & Hanley, 2. p. 325.

BODY somewhat depressed, red, yellow, brown, or of all intermediate shades of those colours: *mantle* circular: *cirri* or tentacular filaments arranged in two or three rows, ciliated or feathered, yellowish-white: *mouth* large, with a pair of long delicate lips on each side: *foot* short, cylindrical, and white, sometimes curved and protruded from a slit in the shell above the orifice, for the purpose of spinning a byssus and affording an additional means of attachment.

SHELL round, oval, oblong, cylindrical, angular, or even amorphous, compressed, and sometimes flattened, of different degrees of thickness according to age, outside of a dull appearance, although the inner layers are remarkably glossy and iridescent: *sculpture*, scaly and sometimes prickly, minutely striate in a longitudinal direction, and marked by irregular lines of growth: *colour* white, with often a yellowish, pink, rose-red, or brown tint: *margins* thin, rounded or wavy unless contracted by position, nearly forming an obtuse angle behind: *beak* straight and very small, not projecting beyond the dorsal margin: *cartilage* short but strong, broad, semilunar, and fixed in a cavity underneath the beak: *hinge-line* slightly curved: *hinge-plate* thick and broad: *orifice* oval; outer edge reflected: *inside* silvery and iridescent, sometimes having a green tint, furnished in the lower valve at the hinge-end with a thickened ledge, to receive and support the cartilage: *muscular scar* large, showing in the upper valve the impressions of three inner portions of the muscle, which are nearly circular and disposed in a descending but irregular line from the hinge, and in the lower valve only one similar impression, which is placed on the right hand of the observer: *plug* cylindrical, thick, and longitudinally striate. Length 2·3, breadth 2·5.

HABITAT: From low water-mark to 80 fathoms on every part of our coasts, attached to shells, stones, seaweeds, and other substances. In a fossil state it occurs in our newer tertiaries, as well as in the Coralline Crag, and in the Italian pliocene deposits. It is likewise found in the post-glacial beds of Bohuslän, Sweden, associated with arctic shells. It is widely distributed in the European seas, from Iceland to the Ægean Archipelago; and its

range also comprises Algeria, Madeira, North America, Russia, Lapland, and the Black Sea. Danielssen has recorded it as having been dredged in the Scandinavian seas at a depth of 180 fathoms.

In consequence of the lower valve being moulded on the extraneous bodies to which it is attached by the plug, the upper valve partakes of a corresponding impression, and the result is that the shell puts on a Protean variety of shape. Bouchard-Chantereaux says that out of two hundred specimens it is almost impossible to find two exactly alike.

When a specimen is affixed to a *Pecten*, *Astarte*, or other ribbed shell, it is similarly sculptured. No less than thirty-four species have been made out of the one now described, and naturalists of every country have had a hand in this wholesale manufacture. Eighteen of these species have been enumerated as synonymous by Forbes and Hanley. The variability of the shell, however, is now such an established fact, that a conchologist who would attempt to restore any of these so-called species must have greater ingenuity than even the learned knight, of whom it was said—

“He could distinguish and divide
A hair, ’twixt south and south-west side.”

The variety “*squamula*” is flatter and smoother than usual; “*aculeata*” has the imbricated scales pinched up into vaulted or hollow spines; and the narrow form of “*cylindrica*” arises from the young *Anomia* selecting for its resting-place a small stem of sea-weed, which obliges it to assume a saddle-shape, not having any room for lateral development. Occasionally specimens are found exhibiting the characters of more than one variety, being half “*squamula*” and half “*aculeata*.” The animal is said to be

poisonous, and Mr. McAndrew informs me that the captain and some of the crew of his yacht were suddenly taken ill at Vigo, after having eaten some fine *Anomia*, which looked to them temptingly like oysters. (j) The muscle of attachment appears to have an excavating or eroding power, like the foot of a limpet or other boring mollusc.

When an *Anomia* is fixed to the shell of an oyster, the lower part of the plug is sunk below the level of the surface, and is separated from it by a kind of sloping ditch. This gives a stronger hold, and the base of the plug is often spread out, so as to increase the fulcrum.

The structure of the plug is very remarkable. It is composed of perpendicular plates, which are alternately

(j) In his "History of the Oyster," p. 26. (London: Van Voorst, 1858) Professor T. C. Eyton says:—

"The Rock Oyster, *Anomia*, is not bad eating. I was particularly struck with the size of those I found in Glengarriff Bay, on the West of Ireland.

I believe that Delle Chiaje is right, when he says that the Mussel and Oyster are poisonous in summer; and probably this is the case more or less with all shell-fish that have spawned, or are just about to spawn, and that those which, when out of season, are sold in the London market, are not fit for food. I have seen the effects of eating out of season mussels, which cause great derangement in the system; but I have not seen anyone made ill by oysters, although the same effects might be expected, and occurred at Havre. The 'Green Oyster,' formerly in such high repute, is now gone out of fashion, and those with white beards are esteemed the most. The green colour at Burnham, Mr. Sweeting informs me is imparted by a species of diatom growing on the beds, this is probably not unwholesome: but there is another green oyster, found on some portions of the Welsh coast, which I should most decidedly think was; it is said to be coloured with copper from the mines."

high and low; and the striated appearance of the top or outer covering is produced by the edges of the higher plates. This appendage is capable of receiving a high degree of polish, and in that state resembles ivory and is equally close-grained. In the fry the orifice is larger in proportion to that of the adult, and is placed on one side. The beak of young specimens is sometimes much produced, and at other times slightly incurved. When the shell is thin, the long muscular scar seen through the upper valve resembles a white line. The varied and nacreous hues of the shell rival in lustre those of the opal.

A group of these specimens from Lulworth Cove, on a valve of *Pecten opercularis*, now before me, are of different colours, white, yellow, and pink, and reflect their pearly gleams in every direction. In substance the shell bears some affinity to talc. Specimens from Bantry Bay, Lough Strangford, and Exmouth roads, are larger than usual. One from the first-named locality measures four inches in diameter. Now and then, but rarely, the upper valve is flat, and the lower or perforated valve is convex; and in one case the front half of the shell is divided into two distinct lobes, owing to the continual obstruction and irritation caused by a small branch of *Sertularia abietina*, which had insinuated itself and grown up in front of the *Anomia*.

But a more curious instance of an adaptation to circumstances is presented by specimens which I found many years ago on a mussel-bed in Swansea Bay, laid bare by an unusually low tide. The orifice in every specimen was completely closed by a series of thin vaulted plates, of the same material as the shell. All the specimens were living, and attached to the mussels by the byssal threads of the

latter. It appeared to me that, having been accidentally detached from oysters in an adjoining bed, to which they were originally affixed, and being thus deprived of their plugs, as well as of the power to make new ones, they filled up the openings with a shelly substitute, for the sake of protection against starfishes and other enemies. Having lost their own plugs, they were well^e satisfied by being securely moored to the bed by the strong cables of their friendly neighbours, the mussels.

I dredged a specimen of the variety "squamula" off Croulin Island, Skye, which was free, but had the orifice completely closed in the same way as the Welsh examples. The *A. tubularis* of Turton is a young specimen of the same variety, in which the orifice had only been partially closed. Old Martin Lister was well acquainted with the typical form, and gave an excellent figure of it in his "Historia Conchyliorum."

2. ANOMIA PATELLIFORMIS. Linné.

Anomia Patelliformis. Linnæus, Syst. Nat., p. 1151.

Forbes and Hanley, 2. p. 334.

BODY resembling that of *A. ephippium*, but the colour is deeper: *mantle* thinner: *cirri* of unequal length and size, and capable of considerable extension, some of them being a quarter of an inch long; they are minutely and closely ringed, and a dusky line runs down the middle of each. No other part of the animal is visible outside.

SHELL round or sometimes longitudinally oval, usually flattened, thin, rather glossy towards the beak, but elsewhere of a dull appearance: *sculpture*, fine and close-set imbricated scales, and 20-30 blunt ribs, which radiate from the beak in every direction towards the margins, in a wavy

manner; lines of growth irregular: *colour* yellowish-white, with frequently reddish-brown, but not continuous streaks or spots: *margins* thin, scalloped or notched by the ribs, nearly straight behind: *beak* small, rather prominent, very seldom reaching to the hind margin, and never overlapping it: *cartilage* short and narrow, fixed in a cavity beneath the hinge: *hinge-line* slightly curved: *hinge-plate* thick but narrow: *orifice* rather large, much broader below than above; outer edge not reflected: *inside* bluish-green, highly iridescent, furnished in the lower valve with a ledge to receive the cartilage: *muscular scar* large, showing in the upper valve the impression of two inner portions of the muscle of a roundish-oval shape and often confluent, the larger one of which is placed in the middle, and the smaller one a little below it on the left hand side; in the lower valve there is only one impression, placed as in the last species: *plug* pear-shaped, thin, and coarsely striate lengthwise. Length 1·3, breadth 1·45.

Var. striata. Shell sometimes nearly-convex, covered with numerous and fine longitudinal striæ, which often rise into minute scales, becoming prickly and occasionally decussated by the transverse lines of growth; coloured rays more distinct and somewhat wavy. *A. striata*, Lovén, Ind. Moll. Scand., p. 29. F. & H., 2. p. 336, pl. 55, f. 1. 6, and pl. 53, f. 6.

HABITAT: 10-86 fathoms, on hard ground and shell-banks everywhere, usually concealed in the hollows of old bivalves. It is, however, not so common as the last species, although equally diffused; and they are found together. The variety occurs in Shetland and on the west coast of Scotland. *A. patelliformis* is a tertiary fossil of the Clyde beds, and of the Red and Coralline Crag, as well as

of the newer deposits of Italy and Sicily, and also of the Uddevalla shell-bed. Abroad this species ranges from Scandinavia to the Mediterranean. According to Chierighini, it inhabits the Adriatic; Weinkauff has included it in his list of Algerian shells, under the name of *A. pectini-formis*, Philippi; the variety, as well as the ordinary form, have been taken by M. Martin in the Gulf of Lyons; Middendorff has recorded it from Sitka Sound, and Dr. Philip Carpenter from the north-west coast of America.

It differs from *A. ephippium* in its more regular outline, thinner texture, coloured streaks, peculiar sculpture, the number and position of its muscular scars, and flat (instead of raised) plug. It is also not so susceptible of outward impressions as that species. An *A. patelliformis* attached to a scallop, although it sometimes partakes of its companion's ribs, has also its own natural ribs, which run their independent course from the beak to the margins. The orifice in young specimens is nearly round. The prominent beak somewhat resembles the apex of a limpet. The plug lies in a hollow which is apparently made in the same way as I have suggested with regard to the other species. Owing probably to the green colour of the liver, the rostral area or nucleus of the shell always appears to have a similar tinge.

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A. patelliformis has not received so many names as *A. ephippium*, and I can only find fourteen of them.

The *Ostreum Striatum* of Da Costa (but not that of Lister) appears to be this species. It has been placed by some conchologists in the genus *Placunanomia* of Broderip; but the distinctive character of that genus lies in having

two cardinal teeth, as in *Placuna* and *Placenta*, and is not applicable to the present species.

Family II. OSTREIDÆ, Broderip.

BODY round: *mantle* having rather thick edges in front: *cirri* short: *gills* simple. There is no foot, or muscle for external attachment. The animal is fixed in the earlier stage of its growth, and sometimes in its adult state, by the lower or more convex valve of its shell.

SHELL circular, longitudinally oval or oblong, or of an irregular shape, and inclined to be wedge-like, inequivalve: *hinge* toothless, but having its margins sometimes notched: *cartilage* internal, short and curved, placed horizontally on the hinge-line.

Some genera are exotic, and others are extinct or known only as fossil. We have but the typical genus. The oyster family differs from that of *Anomia* in the gills being simple, in having no foot or plug of attachment, and in the shells being either free or adhering to other substances by the lower valve, which is invariably larger and deeper than the other.

Genus OSTREA, Linné. Pl. 1, f. 5.

BODY compressed.

SHELL composed of numerous imbricated or tile-like plates, which overlap one another in succession: *beaks* disunited: *cartilage* strengthened by a ligament on each side of it.

The so-called species of *Ostrea* are exceedingly numerous, and many of them are only distinguishable by very slight characters. Almost every sea appears to have

several species or varieties. Their general form is very inconstant and often irregular. It is more than probable that when a sufficiently extensive series from each place, and especially in the earlier stages of growth, have been carefully examined and compared, many recent species may become "extinct" in consequence of a reduction in number, and with great advantage to science. Poli gave the animal the name of *Peloris*. But that was not an oyster.

Murice Baiano melior Lucrina peloris,
Ostrea Circeiis, Miseno oriuntur echini,
Pectinibus patulis jactat se molle Tarentum.

OSTREA EDULIS, Linné.

O. edulis, Linn. Syst. Nat., p. 1148, F. and H. 2,
p. 307, pl. 54, and (animal) pl. 1, f. 1.

BODY much compressed, although rather thick, of a pale drab colour, more or less tinged with brown: *mantle* nearly circular: *cirri* arranged in two rows, the outer one of which is double but irregular, and the inner one single: *mouth* furnished with a pair of large and nearly triangular lips on each side.

SHELL round in its young state, and afterwards spreading out in front or at the sides, with frequently a more or less curved outline, usually compressed, rather thick, of a dull appearance outside: *sculpture*, foliated or scaly; lower valve sometimes strongly ribbed lengthwise; the entire surface of the shell when young is microscopically shagreened; lines of growth well marked: *colour* yellowish-brown: *margins* thin and closely appressed or squeezed together, usually semicircular in front and more or less rounded at the sides: *beaks* small, divided by the *cartilage*,

which is thick and very strong, light-brown or horn colour, and supported on each side by a short ligament of a dark olive-green : *hinge-line* narrow and nearly straight : *hinge-plate* thick : *inside* white and pearly ; lateral edges (especially of the flat valve), finely crenulated or notched on the upper part : *muscular scar* obliquely transverse, pear-shaped or slightly incurved above. Length 3, breadth 3·5.

Var. 1, *parasitica*. Shell much smaller, flatter, and more glossy ; colour purplish or greenish-brown, with streaks of a darker hue radiating from the beaks. *O. parasitica*, Turt. Conch. Dict., p. 134, f. 8.

Var. 2, *hippopus*. Shell large and extremely thick. *O. hippopus*, Lam. An. sans Vert. 7, p. 219.

Var. 3, *deformis*. Shell small, distorted, and often nearly cylindrical. *O. deformis*, Lam. l. c., p. 229.

Var. 4, *Rutupina*. Shell small, transversely oval, and of a regular shape.

Var. 5, *tincta*. Shell flattened and attached in every stage of growth ; inside of a rich purplish-brown or olive-green ; hinge-margins strongly crenulated.

HABITAT : 0-45 fathoms, on every part of our coast, from Shetland to the Channel Isles, usually gregarious and forming beds of various extent. Var. 1, on shells, crabs, and other substances, having rather a more southern distribution. When this variety is affixed to a ribbed scallop, it adopts the markings of that shell, but it retains its own colour. It appears to be the *O. depressa* of Philippi. Var. 2. In deep water and solitary. Var. 3. Occupying the crevices of rocks, in the littoral and laminarian zones, and called the "rock oyster." Some specimens resemble the *Gryphæa* in shape. Var. 4. Coasts of Essex and North

Kent, in a semi-cultivated state, and well known in this country as "natives." Var. 5. West of Scotland and Burra Isles, Shetland. Mr. Grainger has noticed this ubiquitous species as "imbedded in considerable myriads" in a raised pliocene deposit at Belfast; and, according to Mr. James Smith and Mr. Geikie, it occurs in the Clyde beds and other glacial deposits in Scotland. Red and Coralline Crag (S. Wood).

The shells may also be seen mixed with those of peculiarly arctic species in the raised sea-beds near Uddevalla. It is very difficult to ascertain its foreign distribution, with any tolerable degree of correctness, in consequence of its specific identity being enveloped in such a cloud of different names. Depending, however, on those authorities which appear to be most accurate, I consider that its range extends from Iceland (Mohr) to Naples (Scacchi) and the Adriatic (Chierighini). I can answer for the common form, as well as the variety *parasitica*, being found at Cannes. Müller, Lovén, Lilljeborg, Asbjörnsen, and Malm, have recorded it as inhabiting different parts of the Scandinavian sea, from Christiansund southwards; and Mr. McAndrew has found it in Vigo Bay and off Gibraltar. Philippi says that in Sicily it occurs in a fossil state only. According to Gould, it is indistinguishable from the oyster of New York. It has not been observed by Dr. Otto Torell, or any arctic explorer, on the coasts of Greenland; but it is common in some of the postglacial beds near Uddevalla, and in the diocese of Christiania, associated with high-northern shells.

Although we are now favoured with only one species of what Gmelin termed the "vermis sapidissimus," and the supply is never equal to the demand, the case was very

different in days long since past. E. Forbes says :—
“During ancient epochs, as we learn from the fossils of both tertiary and secondary strata, many more kinds of oyster lived within our area, and multiplied so as to rival the contents of any modern oyster-beds. The discoveries of geologists open scenes of regret to the enthusiastic oyster-eater, who can hardly gaze upon the abundantly entombed remains of the apparently well-fed and elegantly-shaped oysters of our Eocene formation, without chasing ‘a pearly tear away,’ whilst he calls to mind how all these delicate beings came into the world, and vanished, to so little purpose.”

However, there is some consolation in the idea that the breed of oysters may have since improved by “natural selection,” and that, if any of our prehistoric ancestors existed in those bygone epochs, they were not so well off as we are for the quality of this gastronomic luxury. Oysters seem to have been as much sought for and enjoyed in the “stone” age as they are at present, judging from the vast heaps of large empty shells which are found in the Danish Kjökkenmoddings (kitchen-middens), as well as in the northern parts of the British isles.

Lister was the first to describe the anatomy of the oyster, from particulars which were communicated to him by Dr. Willis. This description is tolerably accurate ; and if the authority could be wholly relied on, these molluscs ought not to suffer the discredit of being so stupid as is proverbially alleged in Norway and Brittany. Willis states that when the tide comes in they lie with their hollow shells downwards, and when it goes out they turn on the other side ; and he adds that they do not remove from their places, unless in cold weather to cover themselves with the

ooze. Lister appears to have trusted too much to his friend, and not to have learnt for himself the fact that oysters have not the slightest power of locomotion, except in their embryonic state. Bishop Sprat's account of our oyster fisheries, which has been so often quoted in works on natural history, was chiefly compiled from this communication of Dr. Willis. The "spat," said to be like a drop of candle-grease, is a pure fiction.

From April to July the ova are continually excluded from the ovary and discharged into the gills, where they are hatched. Every batch of fry in succession is then committed to the sea, and the young commence life a free animal, like other bivalves, swimming, or rather flitting about with considerable rapidity, by means of numerous cilia which fringe their circumference. Each is enclosed in an extremely thin and prismatic semi-globular bivalve case. Mr. Eyton says, speaking of the appearance and habits of the oyster fry:—"The semitransparent animals, with two reddish elongated dots placed on each side beside the cilia (which were in constant and rapid motion), were exceedingly tenacious of life, the cilia moving until the water was dried up upon the glass. Some that I placed in a little salt and water were alive the next day." "After a short enjoyment of freedom, they attach themselves to a stone or some other object, and the mantle soon begins its object of secretion, and converts the case into a shell; the latter becomes agglutinated to some extraneous body." the cilia and eye-like spots disappear, and the permanent organs are developed. This metamorphosis has its parallel in the Cirripedia and other classes of invertebrate animals. The parent oyster is slow in recovering from its long continued parturition, and it is not fit to eat until about the middle of August. Indeed, it is not con-

sidered to be in full flavour until September. The period of its longevity is not known. It is said to be in prime condition from the fourth to the seventh year, and rarely to live beyond its fifteenth year. If the numerous laminæ or plates of which the shell is composed denote the marks of annual growth, some individuals must attain a very venerable age; but these are formed inwardly, instead of outwardly as is the case with coniferous trees, and the analogy therefore fails. A severe winter causes great mortality among those which are laid in parcs or shore-beds, in consequence of the valves being closed by ice during the recess of the tide. In all probability the stock of seawater, which had been taken in before the oyster was laid bare, requires occasional aëration from the atmosphere. The green colour, so much prized by the Parisians, is owing to the oyster feeding on the *Navicula*, a kind of Diatom or vegetable organism which abounds in comparatively still and brackish waters. According to physiologists, the intestine passes the heart without coming into contact with it, being an exception to the general rule with respect to the relative position of these organs in the Acephala. The oyster, therefore, cannot in fairness be twitted with the proverb that the way to the heart is through the stomach. Nor is the idea of its being "crossed in love" less fallacious, seeing that each individual is of both sexes, and can only be enamoured of itself.

Clark, as well as Sowerby, asserts that the animal has *two* adductor muscles, and that the corresponding impressions may be seen in each valve, the posterior one being very small and placed close to the hinge. I have not been able, however, to detect more than one impression, which lies nearly in the middle. I would therefore invite the

attention of naturalists to the elucidation of this simple point. On it depends the Lamarckian division of the Lamellibranchiata into Monomyaria and Dimyaria, the oyster being the type of the former group.

Dr. Fischer says that the adductor muscle in *Pecten* (which is allied to the oyster, and belongs to the same group,) is divided, so as to form anterior and posterior bundles placed at different angles. He is of opinion that the group of Monomyaria exists only in appearance, and not in reality. The cartilage and ligament advance with the growth of the animal, in consequence of which the old layers become useless and are external. The oldest or first-formed portions of the shell cease in time to be occupied by the animal, so that the beaks become disunited, and in adult specimens are separated by a wide chasm. The shell is remarkably calcareous, and consists for the most part of layers termed by Dr. Carpenter "sub-nacreous," and having comparatively little adhesion one to another. These layers are internal. The outer layers are composed of prismatic cellular structure, and have no natural cohesion. The weight of the animal in a full-grown example is very disproportionate to that of the shell.

The late Mr. Thompson, of Belfast, ascertained that a large oyster from that bay weighed altogether two pounds, but that the weight of the animal taken out of the shell was only an ounce and a half.

Large-sized specimens from the British seas seldom exceed six inches in length; but on the North American coast this species (if it be the same as ours) is said to attain occasionally twice that size. Young shells are sometimes marked with radiating purple streaks, and now

and then one is found attached to the operculum of a living *Buccinum undatum*, the surface of which it completely covers, and takes its form.



CHAPTER IX.

VARIETIES OF OYSTERS.

CLASS CONCHIFERA (CONTINUED).

THE PECTINIDÆ—GENUS PECTEN—PECTEN PUSIO—PECTEN VARIUS
—PECTEN OPERCULARIS—PECTEN SEPTEMRADIATUS—PECTEN
TIGRINUS—PECTEN TESTÆ—PECTEN STRIATUS—PECTEN SIMILIS
—PECTEN MAXIMUS—HAMMER-HEADED OYSTER.

Family III. PECTINIDÆ, Lamarck.

BODY oval or oblong, compressed: *mantle* having thick edges: *cirri* long and extensile: *gills* reflected: *foot* developed.

SHELL spade-shaped, usually inequivalve and inequilateral: *beaks* small, straight, and pointed, with lateral triangular processes like ears or wings: *hinge* toothless: *cartilage* internal, placed in a cavity beneath the beaks and strengthened by a narrow ligament on each side.

The animal has a distinct foot, which is capable of spinning a byssus, or bundle of horny threads, for attachment to other bodies. It is also endued with a peculiar power of locomotion. By a muscular action, analogous to

that which is known as systole and diastole, and by repeatedly taking in and expelling a quantity of water, it flits or jerks itself along for a considerable distance, although not in a straight line, flapping the valves of its shell inwards like the wings of a bird in full flight. The ventral margins are in front, the beaks are behind, and the less convex valve uppermost. But as the "beak" of a shell is posterior, and that of a bird anterior, their relative position is reversed, although the motion of each is nearly the same. Even *Pecten pusio* in its younger state, and before it is permanently fixed, is free and can swim about like its congeners. In other respects also this family differs from the *Ostreidæ*. The shell is of a more regular and symmetrical shape, and its hind margin is expanded on each side into the ears or winglike processes above noticed. Its structure is less compact—its composition, according to Mr. Sorby, being "arragonite," while that of the oyster is "calcite." The impression of the great adductor muscle is placed more on one side than in the oyster, where it is almost central. The muscle by which the front edge of the mantle is attached to the shell leaves a conspicuous scar on the inside of each valve. The cartilage and ligament advance with the growth of the animal, in the same way as in the oyster, but more slowly. All the British *Pectinidæ* are ribbed or striate lengthwise. *Pecten similis*, which is commonly smooth, is hardly an exception, for it sometimes has distinct ridges diverging from the beak to the margin of the shell.

Genus I. PECTEN. Pliny. Pl. 2. f. 1.

BODY oval: *mantle* fringed with ocelli or eye-like tubercles.

SHELL more or less inequivalve : *ligament* internal : *muscular scar* nearly central.

The name of this genus is nearly as ancient as that of *Ostrea*. It is very expressive, the shell usually having ribs which are arranged like the teeth of a lady's comb. Sometimes it resembles the expanded frame of a fan. Scallops are especial favourites of shell-collectors and amateurs, on account of their elegant shape and their brilliant and varied hues. The curious organs called "ocelli" or eye-lets are supposed by some physiologists to be rather highly organized, and even superior to the so-called eyes of most Gasteropodous Mollusca. More than one hundred of them have been counted in a single individual of some species of *Pecten*. For this reason Poli called the animal *Argus*. These little eyes have a prismatic lustre, and gleam like precious stones which are set round the inside of a casket lined with mother-of-pearl. Their structure has been lately and independently investigated by Grube, Khron, and Will. Very young shells of all the species are destitute of ribs, and they are nearly rhomboidal, owing to their breadth and the size of their ears being proportionally greater at that stage of growth than afterwards is the case. In consequence of the scallops being generally attached or sedentary, the upper valve is more deeply and brightly coloured than the lower one.

Although all the essential characters of the present genus are uniform and do not vary much in the several species, it has been divided by authors into no less than twenty-eight, most of which will be found enumerated in the useful Index of Herrmannsen. In nearly all the British species the upper or left valve is the larger, and is also distinguished from the other by its brighter or deeper hue.

In *Pecten maximus*, however, and occasionally in *P. septemradiatus*, the lower or right valve is the larger, and almost or quite colourless. The intensity of colour is supposed to depend on the action of solar light, although it is not wanting in animals living in the abysses of the ocean, which the most attenuated sunbeam has never directly penetrated.

A. Upper valve more or less convex: *hinge-line* ribbed across.

1. PECTEN PUSIO, Linné.

Ostrea pusio, Linn. Syst. Nat., p. 1146. *P. pusio*, F. and H. 2, p. 278, pl. L. f. 4, 5, and 51, f. 7.

BODY vermilion or yellowish-white, with a brown tint, or particoloured: *cirri* numerous, short, and blunt, arranged in from 5 to 7 rows: *ocelli* large and few in number.

SHELL varying in shape according to age, being when young considerably longer than broad, and regular, but in its adult state broader in proportion, and distorted or twisted in consequence of its fitting the cavities and sinuities of the bodies to which it is fixed; in the earlier stage of growth it is almost equivalve, but afterwards the upper valve becomes usually the larger and more convex of the two; sides nearly equal; it is rather solid, and not glossy: *sculpture*, about 70 narrow and sharp ribs, which are alternately large and small, crossed by numerous transverse plates, which by their intersection form scales or prickles on the crests of the ribs; the whole surface is exquisitely marked by microscopical longitudinal striæ, which diverge from each successive layer of growth; in the fry these striæ only are visible, the ribs not then

existing: *colour* reddish, yellowish, brown, or white, or of intermediate shades, variegated by straight or diverging streaks or blotches of some of those tints: *margins* rounded in front and at both sides, and notched or indented by the impression of the ribs; in the young the upper edge of the angle on the right-hand side, which lies under the large ear, has a row of curved spines, which are arranged like the teeth of a saw: *beaks* prominent: *ears* of unequal size, especially in the young, that on the left-hand side of the upper valve and on the right of the lower valve being the largest; all of them are sculptured like the rest of the shell, the ribs diverging from each side of the beak outwards; the right hand ear of the lower valve is notched at the base, and it is smaller than the opposite one on the left hand of the upper valve, in order to make an opening and passage for the byssus: *hinge-line* straight: *cartilage* short but strong: *ligament* long and slender: *hinge-plate* strengthened by a thick and knob-like rib on each side of the beak, to form the sides of the cartilage-pit: *inside* pearly, microscopically pitted, and sometimes very finely and closely striate lengthwise: *muscular scars* slight. Length 1.65, breadth 1.45.

HABITAT: N. of Hebr., 530 f. (C. and T.). F. Portrush (Portlock and A. Bell). E. Cape of Good Hope (Dunker)! Every rocky coast from Shetland to Cornwall, often on oyster-beds, and attached in the adult state by the whole or last-formed part of its lower valve to the inside of old bivalve shells, or to rocks, *Eschara foliacea*, and other substances. The depth of water in which it lives varies from 5 to 85 fathoms, and the young are occasionally found at low water mark on some shores where the tide retires for two or three fathoms. In a fossil state *P. pusio*

occurs in the Clyde beds, as well as in the Red and Coral-line Crag. Its extra-British range is considerable, extending from Norway to the Azores on the one side, and to the Ægean on the other.

In more northern seas this species soon fixes itself permanently to various bodies by means of an agglutinating secretion; but in the Mediterranean and more southern latitudes it usually remains free, or attached by a byssus only, from which it has the power of withdrawing or disengaging itself at pleasure. In the former or fixed state it belongs to the genus *Hinnites* of DeFrance. It has been clearly shown, however, by Sowerby, on conchological grounds, and by Dr. Fischer (in 1862), physiologically, that this species is a true *Pecten*, and that the genus *Hinnites* is not maintainable. The peculiar mode of attachment by the shell in this case is the reverse of that adopted by the oyster, the former having the smaller valve and the latter the larger valve uppermost.

The prickly scales are sometimes produced also on the lower valve, and become leaf-like, as in the oyster. In fixed specimens the byssal sinus is more or less closed; but I have some of a large size and much distorted, which were attached by a strong byssus as well as adhering by the shell.

According to Fischer, the foot does not become atrophied or proportionally smaller in the fixed adult, although it is then quite useless for the purpose of locomotion. The fact is opposed to the general idea that the size of organs is modified or affected by a change in the habits of an animal. The present species was first described by Lister with his wonted accuracy. Wallace, in his "History of the Orkneys," has an ingenious way of accounting for the shells being so distorted. He calls them the "twisted

Pectines of Stroma," and says, "I cannot think the odd, strange tumbling the tides make there can contribute anything to that frame ; yet, after all, I never see them in any other place."

It is the *Ostrea sinuosa* of Gmelin and the *P. distortus* of Da Costa. In its younger state it is the *P. multistriatus* of Poli, and the *P. Isabelle* of Macgillivray, but not of Lamarck.

2. *P. VARIUS*, Linné.

Ostrea varia, Linn. Syst. Nat., p. 1146. *P. varius*, F. and H. 2, p. 273, pl. 50, f. 1.

BODY pale red, pink, brown, or yellow, sometimes mottled with white or streaked with purplish-brown : *mantle* broad-edged : *cirri* numerous, of unequal length but mostly long and slender, arranged in four rows : *ocelli* about 30, black, and smaller than in the last species : *foot* rather large, thick, and white.

SHELL transversely oval, much broader in front than behind, nearly equilateral, rather solid and slightly glossy : *sculpture*, 25-30 smooth and rounded ribs, which are equal-sized ; the whole surface is covered transversely with fine plates, which often form vaulted spines on the crests of the ribs ; the interstices of the ribs are marked with minute bifurcating striæ : *colour* red, pink, yellow, purple, brown, and rarely milk-white, with streaks or blotches variously disposed : *margins* rounded in front and at the sides, and notched or indented by the ribs, sloping abruptly to the beak on each side from a little above the middle ; upper side of the slope on the right hand of the lower valve toothed or serrate, as in the last species : *beaks* prominent : *ears* unequal and formed as in *P. pusio* ; the right-hand one of the lower valve projects beyond and slightly overlaps

the opposite ear of the upper valve; their markings and the byssal notch are the same as in the last species, as well as the *cartilage*, *ligament*, and internal structure: but the *muscular scars* are more distinct. Length 1·85, breadth 1·65.

Var. 1, *purpurea*. Shell larger, broader, and flatter: *colour* purplish-brown, marbled with yellow.

Var. 2, *nivea*. Shell of the same shape as the last variety, and having about 45 ribs: *colour* snow-white, sometimes tinged with purple, or more rarely orange, yellowish-purple, or brown of different shades. *P. niveus*, Macgillivray, Edinb. Nat. and Phil. Journ. 13, p. 166, pl. 3, f. 1; F. and H. 2, p. 276, pl. 50, f. 2, and (animal) pl. S. f. 3.

HABITAT: F. England and Ireland. E. Christiansund southwards (Sars). Equally common with the last species, and in similar situations; but it does not appear to have been found on these coasts north of the Orkneys, whence a white variety has been procured. The range of depth varies from low-water mark at spring tides to 40 fathoms. Var. 1. Falmouth Harbour and off Portsmouth (J. G. J.); Cork Harbour (Humphreys); Bantry Bay (Barlee). Var. 2. Western coasts of Scotland, in 3-25 fathoms, on *Laminaria saccharina*, and occasionally attached to stones; Glengariff, Bantry Bay (Barlee). As a fossil or subfossil, this species is found in the upper tertiaries of the Belfast, Clyde, and Sussex beds. Abroad it is distributed in every sea, from Bergen (Sars) to the Ægean (Forbes); and according to Weinkauff, it is not uncommon on the Algerian coast.

In the north of France it is called "Petite-Vanne;" and Collard des Cherres says that it is eaten in Brittany, as well as other kinds of scallops. The pallial tentacles or

cirri of the variety *nivea* are extremely interesting and beautiful objects. They are of different colours in the same individual—white, yellow, and brown—and are sometimes edged with black or purple.

Some of them are much longer than others, and each has a white line or streak down the middle. The longest have a few milk-white specks, and their tips are curled like a crosier. A few of these tentacles are three-quarters of an inch long. All are contractile and extremely sensitive. The outermost row folds back over the margins of the shell. The edges of the mantle are studded with papillæ.

The ocelli do not correspond in number or position with the ribs of the shell, there being two eyelets for every three ribs. All the specimens (about twenty in number) examined by me on the 1st of September, 1862, at Oban, shed from time to time a milky fluid which I found was entirely composed of spermatozoa. These moved actively about in every direction, and spread in the water like a thick mist. The quantity emitted by each individual was very great, and after every discharge the water became more turbid. All these specimens had ovaries of a pale-yellow or cream colour.

This seemed to me a sufficient proof of the monœcious character of the scallop; and it showed that the mode of its fecundation is the same as takes place in many plants—only substituting spermatozoa for pollen-dust, and the waves for the wind or winged insects. Forty or fifty years ago, when this pretty variety was not easily procurable, and therefore exceedingly rare, a specimen fetched £2. Fifty or more may now be had for the same price. The fry remove from place to place, at least in the earlier stages of growth.

The hooded crow is very fond of these scallops. It takes one from the tangle at low water, and carries it to the shore or a bank, on which it drops its prey, watching with cunning patience until the scallop opens its shell. It then quickly thrusts its pointed and strong beak into the gaping valves, forces them asunder, and devours the dainty morsel. Dead and bleached shells are thus often found in places at some distance from the sea, where crows had been feasting. Without this explanation they might have been mistaken for fossils.

The only points of difference between *P. varius* and *P. niveus* consist in the latter having a broader and flatter shell, with more numerous and delicate ribs, and in the colour being white.

The strong and few-ribbed *P. varius* lives on oyster-banks and rough ground, on an exposed coast; while the delicate and many-ribbed *P. niveus* is only found in sheltered lochs and arms of the sea, moored by its strong byssus to the upper surface of the broad and smooth fronds of *Laminaria*.

Dr. Gray, in commenting on the species in question (Ann. Phil., No. 59, p. 387), says:—"Macgillivray only compares it with *P. varius*, perhaps not aware that *Pecten Islandicus*, Lam., of which this shell appears to be only a variety, has long been known as a British species." The last-named species, however, has never been found in Great Britain except as an upper tertiary fossil, and it has only a generic resemblance to Macgillivray's shell.

P. Islandicus. F. Gulf of Naples, in 50 f.; a single valve in a semi-fossil state, like those dredged in Shetland, and covered with the same arctic species of *Spirorbis*; with

it was a valve of *P. opercularis*, in the same condition, and as large as northern specimens. E. Finmark to Bergen, where it becomes dwindled, in 5-50 f. (Sars).

P. Islandicus, Müller, once lived within the area which now constitutes the more northern part of the British seas, and nearly the whole of Scotland. It is, however, no longer an inhabitant of our coasts. Dead shells in a semi-fossil state, but occasionally retaining their beautiful pink colour, are not infrequently dredged up on both sides of Scotland and off the coasts of Shetland, close to land, and also at various distances from it, at depths of from 30-80 fathoms. It is not uncommon in pleistocene beds, on the west of Scotland and in the Moray Firth.

The best explanation I can offer for its never having been found alive in any part of our seas is by suggesting that the ancient sea-bed which it inhabited during some part, if not the whole, of the glacial epoch, was afterwards upheaved above the level of the sea, so as to cause the extinction of this and other arctic species, and that at a subsequent period a great part of this district was slowly submerged, and is now again covered by the sea.

We know that this process of elevation in some and depression in other parts of the Atlantic sea-bed is still going on. Sweden and Greenland are instances of the former phenomenon; and to the latter may be referred the discovery by Dr. Wallich of star-fishes belonging to a species which usually inhabits shallow water, living at a depth of 1260 fathoms, as well as the occurrence of *Nassa incrassata* and other littoral kinds of mollusca, in nearly 80 fathoms, off the coast of Shetland. *P. Islandicus* survives and is abundant in every part of the Arctic Ocean, at depths varying from 15-150 fathoms. It has not been recorded as living south of Drontheim, and Malm says

that it does not now exist anywhere on the Swedish coast, although it is common there in a fossil state. This species is not unlike the variety *niveus* of *P. varius* in shape and the number of ribs; but the shell is more solid, the ribs sharper, and the surface resembles shagreen.

3. *P. OPERCULARIS*, Linné.

Ostrea opercularis, Linn. Syst. Nat., p. 1147. *P. opercularis*, F. and H. 2, p. 299, pl. 50. f. 3; 51. f. 5, 6; 53, f. 7.

BODY thick, variegated with pink, cream-colour, fawn, orange, or brown, and mottled with flake-white meandering lines, spots, and blotches: *mantle* thin, except at the fleshy margins: *cirri* conical, white, of unequal length and irregularly disposed in two or three rows, the outer one of which has the longest filaments: *ocelli* 35-40, nearly globose, having pearl-coloured pupils within black circles: *foot* small, subcylindrical, deeply cloven or furrowed, and scoop-shaped at its extremity, of a yellowish-white colour.

SHELL circular and equilateral, except at the back (where the periphery is interrupted by the beak and ears), rather thin, scarcely glossy: *sculpture*, about 20 rounded ribs, which are of equal size and somewhat broader than the interstices; the surface is more or less covered with extremely fine and wave-like transverse plates, which often form numerous rows of short prickles, especially along the ribs and on their crests, making the shell feel rough as shagreen: *colour* red, pink, orange, yellow, purple, brown, or of intermediate shades, often streaked or marked with blotches or spots, and sometimes (but rarely) milk-white: *margins* rounded in front and at the sides, notched or indented by the ribs, sloping gradually to the beak on

each side from about three-fourths of the distance from the front margin; slope below the byssal sinus strongly toothed or serrate: *beaks* prominent: *ears* nearly equal, sculptured by ribs which radiate from the beak; the ears of the lower valve slightly project beyond and overlap those of the upper valve; byssal notch deep: *hinge-line* straight: *cartilage* rather large: *ligament* narrow and slight: *hinge-plate* somewhat broad, minutely striate across; transverse rib strong and raised on each side of the cartilage-pit: *inside* fluted or grooved, so as to correspond with the folds of the outside ribs; each shoulder under the ear is furnished with a thick ledge, which rests on that in the opposite valve, thus giving additional support to the hinge and preventing its being too closely pressed: *muscular scars* distinct. Length 2.35, breadth 2.5.

Var. 1, *lineata*. Shell white, with a brown line running down the crest of each rib. *P. lineatus*, Da Costa, Brit. Conch., p. 147, pl. 10, f. 8.

Var. 2, *tumida*. Shell more swollen and deeper.

Var. 3, *elongata*. Shell smaller, and longer than broad.

HABITAT: N. of Hebr., 530 f. (C. and T.) F. England, Ireland, Scandinavia, and Italy. Common on all sandy coasts, and gregarious, in 6-90 fathoms. Var. 1. Not infrequently found with specimens of the usual colour, and sometimes having a mixed hue. Var. 2. Plymouth (J. G. J.); Exmouth (Clark); Cork (Humphreys). Var. 3. Loch Torridon, Ross-shire (J. G. J.); Birterbuy Bay, co. Galway (Barlee): rare. This species is a common fossil in the Scotch glacial deposits, and in the Norwich, Red, and Coralline Crag. Steenstrup informs me that he has found it in Iceland; Mohr has recorded it from the

Faroe Isles, Weinkauff from Algeria, Forbes from the Ægean, and McAndrew from Madeira; and it is widely distributed throughout the intervening seas.

This pretty and well-known species was first described by Lister. Mr. Norman says that quantities are dredged in the Firth of Clyde, where they are called "clams," for bait in the long line fishery. When cooked they have a rich and agreeable, but peculiar flavour: they are not much eaten in this country. According to Montagu, they are called "frills" or "queens" on the South Devon coast. The fishermen on the Dorset coast call them "squinns." In the north of France this kind bears the name of "vanneau" or "olivette." The shells make pretty pin-cushion-cases, and in the North American States another species (*P. concentricus*) is used for the same purpose.

The Rev. Dr. Landsborough has given the following interesting account of their habits in an earlier stage of growth.—"We observed on a sunny September day, in a pool of sea-water left on Stevenston strand (Ayrshire) by the ebbing tide, what we at first thought some of the scaly brood at play. On close investigation, however, we found that it was the fry of *Pecten opercularis* skipping quite nimbly through the pool. Their motion was rapid and zigzag, very like that of ducks in a sunny blink, rejoicing in the prospect of rain. They seemed, by the sudden opening and closing of their valves, to have the power of darting like an arrow through the water. One jerk carried them some yards, and then by another sudden jerk they were off in a moment on a different tack. We doubt not that, when full-grown, they engage in similar amusements, though, as *Pecten* of greater gravity, they choose to romp unseen and play their gambols in the deep."

The animal of the adult scallop, when at rest, is a study for a painter, with its large and bright pink ovary, and its mantle studded on each side with a row of brilliant eyelets, like dew-drops glittering in the sun of a May morning. The transverse plates form hollow or vaulted scales in young shells, and their surface is minutely and closely tuberculed, like the cells of Polyzoa. In the fry the upper valve is much larger than the lower one, and overlaps it. The ribs are not then formed, but the byssal sinus is well developed. Specimens from the Firth of Forth and Shetland are much larger than usual, although slightly differing from each other in their relative proportions. . . . Occasional distortions or monstrosities occur. *P. opercularis* may be readily known from either of the two foregoing species by its circular form, greater size, and nearly equal ears. The *P. Audouinii* of Payraudau can hardly be considered a variety. Its sculpture is that of the *P. lineatus* of Da Costa, and only differs from that of ordinary specimens in the scales being more regular and continued across the ribs. The *P. subrufus* of Turton is merely the young state, with a straighter outline. Many other specific names have been invented by authors, for still more trifling varieties.

4. *P. SEPTEMRADIATUS*, Müller.

P. septemradiatus, Müll. Zool. Dan. Prodr., p. 248, No. 2992.

P. Danicus, F. and H. 2, p. 288, pl. 52, f. 1-2, 7-10.

BODY whitish, tinged with fleshcolour, and minutely speckled with flake-white; the colour is also diversified by blotches and streaks of dark brown, orange, yellow, or greenish: *mantle* thick, folded inwards on each side; the margin is fringed with numerous cirri or tentacles, which are closely and finely ciliated; they are of different sizes,

encircled by flake-white rings, and arranged in two or three rows on each side; the outermost row contains some of the largest size, which curl at their tips and are mostly of a yellow colour; under this row are placed the "eyes" or *ocelli*, about 50 on each side; these are of different sizes, not arranged symmetrically and black, with a bright silvery pupil or nucleus in the centre.

SHELL nearly circular and equilateral, except as in the last species, thin, somewhat glossy: *sculpture*, mostly 7 rounded but compressed ribs (the middle one being the largest), which are much narrower than the interstices; the surface is covered with minute and close-set longitudinal striæ, which are crossed by equally fine but more remote transverse plates, so as occasionally to form prickles at the point of intersection; the sides are marked with short and stronger striæ, placed at right angles to the longitudinal striæ: *colour* reddish-brown, mottled or streaked with white; *margins* as in *P. opercularis*; slope below the byssal sinus seldom, and never distinctly, serrate: *beaks* prominent: *ears* nearly equal in the upper valve, but not so in the lower valve, in which the right ear is the larger; all of them are sculptured by ribs radiating from the beak, as well as by fine and numerous striæ, which run from the sides or shoulders and diverge outwards; there are also some wavy striæ in the line of growth, crossing the auricular ribs; the ears of the lower valve project beyond and overlap those of the upper valve, but much less than in any of the preceding species; byssal notch slight: *hinge-line* straight: *cartilage* small: *ligament* very thin: *hinge-plate* rather broad, microscopically striate across; transverse rib slight, and raised a little on each side of the cartilage-pit: *inside* fluted or grooved, as in other ribbed

species: *muscular scars* rather distinct. Length 1·625, breadth 1·475.

Var. 1, *alba*. Shell of a milk-white colour.

Var. 2, *Dumasii*. BODY greyish, irregularly streaked lengthwise with dark brown and red, and closely speckled with yellowish-white: *mantle* thick and folded inwards; edges marked with a dark line, and thickly covered with pointed cirri of various lengths and sizes, which are finely ciliated; the longer ones are very extensile, and sometimes curl and unfold to a length equal to half that of the shell: *ocelli* numerous, placed more close together at the sides than in front, where they are alternately large and small; they look like globules of quicksilver, or glistening pearls, or white coral beads set in rings of dark bronze: *foot* finger-shaped, byssiferous, issuing from the notch on the posterior side below the large ears of the shell; it is of a pale orange-colour. The animal occasionally uses its foot for crawling.

This variety is connected with the type by several intermediate forms, as regards both the shell and the soft parts.

SHELL smaller and more solid, longer in proportion to its breadth; upper valve less convex than the lower one, and sometimes quite flat or even slightly concave: *sculpture* coarse, with 3-10 sharp ribs: *ears* often unequal, those on the byssal side smaller than the opposite pair. *P. Dumasii*, Payr. Cat. Moll. Corse., p. 75, pl. 2, f. 6, 7.

HABITAT: F. Ireland and Italy. E. Loffoden I., 300 f. (Sars). Rather plentiful in Loch Fyne, and generally distributed over our northern seas, and southward as far as the Northumberland coast, in 20-90 fathoms, rough

ground. Var. 1, Loch Fyne and Shetland (Barlee). Var. 2, Hebrides and Shetland. This species is fossil in the Clyde basin, and in other glacial deposits in Scotland as well as Norway. It ranges from Finmark to the Ægean, but it appears not to be so common in the south as in the north. The variety *Dumasii* occurs in the upper miocene strata near Antibes.

P. septemradiatus was added to the British fauna by the late Captain Brown, in 1835. It is remarkable that such a handsome and by no means small shell should have previously escaped the notice of Laskey, Fleming, Macgillivray, and others of our northern conchologists. . . . The shell is extremely variable in respect of shape and the number of ribs, as well as of the proportionate size of the ears. . . . In young shells the surface is regularly cancellated. The fry is glossy, and has very prominent beaks; its sculpture consists of numerous microscopical longitudinal striæ on the upper valve, and equally minute transverse striæ on both valves. A dozen names have been given by different conchologists to this species.

5. *P. TIGRINUS*, Müller.

P. Tigerinus, Mull. Zool. Dan. Prodr., p. 248, No. 2993.

P. tigrinus, F. and H. 2, p. 285, pl. 51, f. 8-11.

BODY bright red or occasionally creamy-white: *mantle* edged with white and mottled with dusky or brown rays: *cirri* short: *ocelli* 10, brown with a golden centre: *foot* white and very flexible: *byssus* transparent.

SHELL of the same shape as the last two species, but rather narrower at the back, moderately solid, and some-

what glossy: *sculpture*, extremely fine and numerous impressed striæ, which radiate from the beak and gradually diverge to the front and side margins; these striæ are not visible to the naked eye, and under a strong magnifier they appear regularly but slightly punctured, in consequence of the intersection of equally minute and close set transverse striæ, which follow the line of growth; the longitudinal striæ are sometimes irregularly waved or interrupted, and are often forked: *colour* yellow, brown, or purple, and now and then white, with variously disposed bands, streaks, blotches, spots, and other markings of those hues: *margins* rounded in front, so as to form a semicircle, and sloping from near the middle to the beaks, at an angle of about 45 degrees; the front margin is sometimes folded inwards and strongly notched; the upper part of the slope below the byssal sinus is finely toothed: *beaks* very prominent, and considerably raised: *ears* unequal; those on the left hand of the upper valve and right hand of the lower valve are at least four times the size of the others; all of them have a few strong ribs which radiate from the beaks, and they are also marked with coarse and numerous striæ, which cross the ribs obliquely; the ears of the lower valve project very little beyond those of the upper valve; byssal notch deep: *hinge-line* straight: *cartilage* small: *ligament* very thin: *hinge-plate* narrow, microscopically striate across; transverse rib strong and considerably raised on each side of the cartilage-pit: *inside* nacreous, finely and closely striate lengthwise, and notched on the front margin; within the larger ears are strong grooves, which correspond with the outside ribs: *muscular scars* distinct, especially in aged specimens. Length 0.9, breadth 0.885.

Var. *costata*. Shell stronger than usual, and having either five ribs and intermediate small ones, or else several

riblets of equal size : inside grooved and striate accordingly.

HABITAT : N. of Hebr., 170-189 f. (C. and T.), F. Norway (Sars and others) ; Messina (Seguenza) ; ! E. Holland (Herklots) ; Brittany (Récluz and others) ; Arcachon (Lafont). ! Not uncommon from Shetland to the Channel Isles in 7-82 fathoms, on a sandy bottom mixed with gravel ; and the variety is equally diffused. This species occurs as an upper tertiary fossil in the Scotch glacial deposits, and also in the Red and Coralline Crag. It is a native of the Icelandic and Scandinavian coasts, and McAndrew has taken it in Vigo Bay, at a depth of only 8 fathoms.

The shell varies greatly in size and proportions, as well as in colour and the number of ribs. My largest specimens are one inch and two-tenths long, and nearly the same in breadth. Sometimes the breadth slightly exceeds the length. Young shells are proportionally longer than old ones.

In the former the so-called "eyes" are perceptible, through the semitransparent shell, many years after the animal has ceased to exist. The fry are not sculptured, but perfectly smooth, and the lower valve is nearly flat and smaller than the other. Müller noticed the way in which he presumed this scallop procures its food, viz., by rapidly opening the valves of its shell and clapping them together with an audible noise ten or twelve times in succession. It then kept them wide open, and for a much longer time than suited the patience of the great zoologist. By this violent agitation of the water a fresh supply of animalculæ may be brought to its insatiable maw. He adds that it can squirt the water out of a vessel half an ell high ; but I have

never seen it perform such an extraordinary feat. The jet of water would be at least fifty times the length of the animal.

A slight and pardonable liberty has been taken in changing the original spelling of the specific name from *tigerinus* to *tigrinus*. This shell was called *P. parvus* by Da Costa, *P. domesticus* (used of course in the sense of native) by Chemnitz, and *P. obsoletus* by Pennant.

6. *P. TESTÆ*, Bivona.

P. Testæ (Bivona), Philippi. Moll. Sic. 1, p. 81, t. v. f. 17.

P. furtivus, Lov. Ind. Moll. Scand., p. 31.

BODY pale yellowish white, faintly tinged with pink, mottled with dark brown, speckled with flake-white, and barred transversely with 8 or 10 irregular streaks of dark brown: *mantle* fringed with fine tentacles of different sizes, which are delicately ciliated and curl about in every direction; they are arranged in two rows, the outer tentacles being much larger than those forming the inner row; the front edges of the mantle are folded inwards, and appear to be microscopically striated in the line of the opening: *ocelli* half as many only as in *P. striatus*, and consisting of two rows; those in the outer row are unequal in size and irregularly distributed, one being in many cases (but not invariably) placed at the base of each pallial cirrus in that row; those in the inner row are more numerous, much smaller, and not always observable: *foot* cylindrical: *gills* in two pairs, fan-shaped and exquisitely pectinated, sometimes brownish or pencilled in the middle.

It flits or jerks about actively, like its congeners, and occasionally moors itself by a byssus. The colour of the soft parts is not less variable than that of the shell. When

it is at rest, the mantle forms a thick semicircular cushion, striped across with yellow, brown, red, pink, and every intermediate hue.

SHELL somewhat resembling *P. tigrinus* in shape, but rounder and much more depressed, rather thin and glossy: *sculpture* minute longitudinal and transverse striæ, which are arranged as in the last species, but they are more regular and never forked; they are deeply punctured at the points of intersection; sometimes there are also from 30-35 delicate ribs, which become scaly or prickly where they are crossed by the transverse striæ: *colour* yellow, orange, brown, purple, pink, or occasionally white, usually diversified by streaks, rays, blotches, spots, diagonal lines, and other markings of the above hues: *margins* rounded in front, and forming an arc of two-thirds of a circle in consequence of the lateral slopes towards the beaks commencing higher up than in *P. tigrinus*; byssal slope finely toothed: *beaks* prominent, but not much raised: *ears* unequal, those on the byssal side being about twice as large as the other pair; all of them have several fine ribs, which radiate from the beaks and are crossed by coarse flexuous striæ; the edges of the ears on the lower valve project very slightly; byssal sinus deep; *hinge-line* straight, finely notched or serrate at its edge: *cartilage* rather large: *ligament* extremely slight: *hinge-plate* very narrow, microscopically striate across; transverse rib slight, and not much raised on each side of the cartilage-pit, which is proportionally more open than in any of the foregoing species: *inside* slightly nacreous, finely and closely striate lengthwise, or furrowed when the outside is ribbed: *margin* sometimes notched or crenulated: *muscular scars* indistinct, except in aged specimens. Length 0.575, breadth 0.55.

Var. *suborbicularis*. Shell larger, with the slope much higher than usual, and considerably narrower behind: ears smaller. Length 0·7, breadth 0·7.

HABITAT: Cornwall (Hockin). F. Monte Mario (Rigacci); E. Mediterranean electric-telegraph cable, at a depth of over 1000 f. (Milne-Edwards). Shetland, Skye, Larne (co. Antrim), Birterbuy Bay (co. Galway), Guernsey (J. G. J.); Exmouth (Clark); in gravelly sand, 18-80 fathoms. It is a rare species. The variety is remarkable. . . . The foreign range of *P. Testæ* extends from Norway to Algeria and the Ægean. . . . This beautiful species differs from *P. tigrinus*, with which it is sometimes found, in the following particulars:—The shell is broader, flatter, and thinner; the ribs, when they occur, are scaly or prickly; the punctures are very strongly marked, and arranged in squares; the beaks are much less prominent, and raised; the ears are not so unequal; and the inside margin is seldom crenulated. Forbes and Hanley considered it to be a variety of *P. striatus*; but Malm has satisfactorily shown some of the points of difference between these two species. There is no intermediate form. *P. Testæ* has, indeed, some of the sculpture of *P. tigrinus* and the shape of *P. striatus*, but the colouring of the first is more bright and vivid than that of the other two. Some specimens are perfect gems.

7. *P. STRIATUS*, Müller.

P. striatus, Mull. Zool. Dan. Prodrömus, p. 248, No. 2994; F. and H. 2, p. 281, pl. 51, f. 1-4, and (animal) pl. S. f. 2.

BODY whitish, irregularly streaked lengthwise with opaque white lines: mantle edged with white, and having an outer fringe of extensile white cirri: ocelli 25 in num-

ber, blue-black with crimson centres ; behind them is an inner fringe of short white cirri : *gills* also furnished with 20 reddish-brown *ocelli*, each of which surmounts the crest of a leaflet.

SHELL resembling that of *P. Testæ* in shape ; but it is rather larger, thinner, and more fragile, and the *sculpture* (especially of the upper valve) is very different. In the present species it consists of numerous fine ribs, which radiate from the beaks to the front and side margins, and have their crests thickly set with short vaulted spines or prickles ; besides these riblets, the surface is closely covered with extremely minute and irregular longitudinal striæ, which are raised and divaricate or become forked, but they are never reticulated or punctured, as in *P. Testæ*. The colour is of a more sombre hue. The left *ear* of the upper valve hangs down much lower, and is nearly entire instead of being deeply notched, as in that species ; and the byssal sinus is consequently larger. Length 0·725, breadth 0·7.

HABITAT : Plymouth (Jordan) ; F. Scandinavia and Italy ; ! E. Mediterranean and Adriatic ; ! seas of Shetland, Scotland ; north-eastern coasts of England ; north, east, south, and west of Ireland ; Isle of Man, and Scilly ; in 12-90 fathoms, hard ground. Mörch has procured it from the Faroe Isles, and Danielssen from West Finmark. It also inhabits other parts of the Scandinavian coast. McAndrew has dredged it in Vigo Bay, at a depth of 15 fathoms, and Philippi describes it as a Calabrian fossil, under the name of *P. rimulosus*. The shell is sometimes distorted. The pallial ocelli or eyelets are of unequal size and irregularly placed ; they gleam with an opaline lustre. Living specimens which I dredged in 85 fathoms had the

shells highly coloured and streaked. Mr. Norman has noticed, in his list of Clyde Mollusca, that the shells of this species lose their azure blue colour after being kept in a closed cabinet. This is remarkable, because certain colours of shells and other animals (*e.g.*, pink and reddish-brown) fade, and even vanish, unless the light is excluded. In the British Museum it has been found necessary to replace, every two or three years, fresh specimens of many delicate tinted butterflies exposed in the show-cases; and in the museum at Amsterdam the shells are always kept covered, to prevent loss of colour. *P. striatus* attains a greater size than *P. Testæ*. My largest specimen is about an inch long, and a trifle more than nine-tenths of an inch in breadth. The striæ in the present species are *raised* and irregular, and they are never punctured or reticulate. The different substance of the shell, the style and intensity of coloration, and the comparative size of the left ear of the upper valve are also notable marks of distinction. Even the fry of each species exhibits its own peculiar characters.

It is the *P. fuci* of Gmelin, *P. reticulatus* of Chemnitz, *P. Landsburgi* of Forbes, and *P. aculeatus* of Jeffreys.

8. *P. SIMILIS*, Laskey.

P. similis, Lask. Mem. Wern. Soc. 1, p. 387, t. 8, f. 8; F. and H. 2, p. 293, pl. 52, f. 6, and (animal) pl. S. f. 1.

BODY very variable in colour, often pale yellow or whitish, with brown streaks and blotches: *mantle* fawn-coloured, with patches and lines of orange and black: *cirri* short; some are white and others brown, a few being thicker and longer than the rest, and mottled with milk-white: *ocelli* 6-8 in front and nearly twice as many in a

second row behind ; the former are comparatively larger, pearly, and ringed with jet : *foot* of a brilliant orange-colour or white.

SHELL nearly circular but expanding towards each side, where it forms an obtuse angle, and rhomboidal behind in consequence of the projection of the ears, equilateral, depressed, extremely thin and rather glossy ; lower valve considerably smaller than the other, and to some extent enclosed within it : *sculpture*, fine and close-set concentric lines only : *colour* yellowish or milk-white, mottled with reddish-brown or flake-white spots or streaks, and often marked by longitudinal white rays or transverse zigzag lines of a vandyke pattern : *margins* very thin, semicircular in front and sloping about halfway on each side, at an angle of 45 degrees, to the beaks ; byssal slope not toothed or serrate : *beaks* small but prominent : *ears* long and drooping, nearly square-set, those on the byssal side being the smallest, rounded at the corner ; byssal notch slight : *hinge-line* straight, two-fifths of the breadth of the shell : *cartilage* small : *ligament* so thin as to be almost imperceptible : *hinge-plate* broad and smooth ; transverse rib slight and scarcely raised : *inside* pearly, minutely striate lengthwise : *muscular scars* distinct. Length 0·285, breadth 0·3.

HABITAT : Shetland, 95 f. F. N. U. Germany and Italy. E. Loffoden I., 300 f. (Sars) ; Arcachon (Lafont) ; ! Jamaica (Barrett). ! Sparingly occurring, although gregarious, on all our coasts, in muddy sand, at 2-82 fathoms. Glacial deposits, Fifeshire (Fleming) ; Coralline Crag (S. Wood). Its distribution extends from Finmark to the Ægean, and both in northern and southern localities it appears to have a considerable range of depth, viz., 15-200 fathoms, Upper Norway, according to McAndrew and

Barrett, and 27-185 fathoms in the Ægean, according to Forbes. Norwegian specimens collected by Professor Sars are of an extraordinarily large size.

The animal as well as the shell of this tiniest of scallops is very lovely. If, when fresh caught, put into a glass of sea-water, it flits about like a bat for a long time, and then fastens itself to the side of the vessel by a fine and atmost transparent byssus. After a while it slips its cable and resumes its voyage of discovery, until it becomes apparently exhausted by the fruitless search, and lies down on one side. My largest specimens measure only 0.35 by 0.375. The breadth invariably exceeds the length.

For the discovery of this species science is indebted to the late Captain Laskey, although he described and figured it from a right valve only, not having at that time obtained a perfect specimen. It is the *Ostrea tumida* of Turton, *P. pygmaeus* of Von Münster, *P. minimus* of Sars, and *P. Foresti* of Martin. The *P. Grænlandicus* of Sowerby (*P. vitreus* of Dr. Gray but not of Chemnitz) resembles the present species in nearly every respect but that of size. It may be an arctic variety of *P. similis* or (more probably) a direct and "pur-sang" descendant from the original stock.

B. Upper valve nearly flat and concave towards the beak; *hinge-line* ribbed obliquely.

9. P. MAXIMUS, Linné.

Ostrea maxima, Linn. Syst. Nat., p. 1144. *P. maximus*, F. and H. 2, p. 296, pl. 49.

BODY pinkish-white above, and bright red or pink in front: *mantle* variously marbled with brown, black, and white: *cirri* on the inner margin of the mantle short, white, and arranged in a single row; those on the fixed or exterior

margin are of different lengths, and arranged in three irregular rows: *ocelli* of a greenish-blue or purplish hue, forming two rows, and numbering from 30-35; those in the front row are considerably larger than the rest, and correspond with the ribs of the shell: *foot* snow-white, short, grooved, with a spatulate extremity.

SHELL nearly circular, except behind, where the projecting ears give a square outline, equilateral above and nearly so beneath; upper valve slightly raised in the middle, and smaller than the lower valve, which is very convex; it is thick and solid, glossy in the umbonal region, but elsewhere of a dull hue: *sculpture*, 15 or 16 ribs in each valve, which radiate from the beaks and are strong, and nearly as broad as the interstices between them; the ribs and interstices are scored by a few parallel striæ, which are more numerous on the lower than the upper valve; the whole surface is covered with minute and close-set thin concentric plates, which are imbricated or overlap one another like roof tiles: *colour* reddish-brown on the upper valve, with a yellow tint on the lower valve; both valves are sometimes beautifully mottled or marked with bands, zigzag streaks, and spots of burnt umber or bright yellow, suffused with a delicate pink hue; occasionally, but rarely, the colour is white, with an orange tint at the beaks: *margins* semicircular in front, and sloping at the distance of about one-fourth from the hinge-line, at an angle of 30 degrees to the beaks; byssal slope not notched or serrate: *beaks* small and not prominent in full-grown specimens: *ears* exactly equal on the upper valve, and nearly so on the other valve, furnished with a few ribs or striæ which radiate from the beaks; byssal notch closed in the adult state: *hinge-line* straight, rather more than half

the breadth of the shell : *cartilage* large, thick, and strong : *ligament* narrow and rather slight : *hinge-plate* broad, closely and microscopically striate across ; transverse rib strong, and raised on each side of the cartilage-pit ; in the lower or deeper valve are two or three short oblique ribs, which diverge from above the cartilage-pit towards the sides, in wave-like lines : *inside* glossy, tinged more or less deeply with reddish-brown, fluted as in *P. opercularis*, and having similar shoulders or ledges on the posterior slopes, to prevent contact at the hinge-area : *muscular scars* well marked, especially on the upper valve. Length 4·5, breadth 5.

HABITAT : F. Sweden and Italy. E. Spain, from 4 f. downwards (Hidalgo). Nearly everywhere, and often gregarious on banks, in 7-78 fathoms. It is also not uncommon in all our upper tertiaries, both new and old. Its foreign range comprises all the sea-bed lying between Norway and the Canaries, and, according to Sars, it occurs with arctic shells in the "postglacial" beds of Christiania.

If the oyster is the king of molluscs, this has a just claim to the rank and title of prince. In Lister's time they were held in nearly the same esteem ; and the great scallop is even preferred by some, although from its luscious quality it is not so provocative of appetite. I have not heard of its being eaten raw in this country. In the fish-markets of the north of France it is called "grand-pélerine," "gofiche," or "palourde." In other parts of France they have the name of "Coquilles de Saint Jacques," from the Catholics who annually visit the shrine of St. James of Compostella, in Spain, placing the shells in their hats as a testimony of this pilgrimage. These shells are (or were) also worn by pilgrims to the Holy Land.

In the south of England it shares with *P. opercularis* the name of "frill," and in the north that of "clam." According to Athenæus, this or an allied species (*P. Jacobæus*) was used by the ancients for medicinal purposes, as well as for food. Old fishermen have a notion that it is taken in greater quantities after a fall of snow; but, if true, this is difficult of explanation, because a scallop never burrows or lives anywhere but on the surface of the seabed. They used to be plentiful in Lulworth Bay, on the Dorset coast; but now they are rarely found alive. I was told that the breed had been exterminated there by an epicurean officer of the coast-guard.

. Nor were the shells less prized in the days when Ossian sung. The flat valves were the plates, the hollow ones the drinking-cups of Fingal and his heroes, and "the joy of the shell went round." The animal of *P. maximus* has long attracted the attention of naturalists. As Clark observed, "When the valves are opened, and the mottled surfaces of the double margins of each valve are in conjunction, and the various circles of filaments and cirri fully exerted in a shallow basin of seawater, it is scarcely possible to conceive a more beautiful and interesting appearance."

The animal is small compared with the size of the shell. This is also the case with other kinds of *Pecten*; and it may be owing to the expansibility of the organs, which require much space for their action. Donovan mentions a strange idea, which was entertained by "modern as well as ancient authors," that the way in which scallops leap or raise themselves up is by forcing the under valve against whatever they lie upon! Shells sometimes attain an enormous size. Dr. Landsborough says he measured one which was 8 inches long. I have

another specimen that is barely $\frac{1}{25}$ th of an inch long. The young are attached by a byssus. They are quite smooth, and in the place of ribs a few fine white lines radiate from the beaks, as is not infrequently seen in *P. similis*.

This might be considered, by the advocates of a theory which was once put forward in the "Vestiges of Creation," a case of arrested development as regards *P. similis*; but they ought to be aware of the fact that both these species of every age inhabit the same spots and yet retain their own distinctive characters. One species never grows or merges into the other. The young of *P. maximus* may be known from *P. similis* of the same size by the upper valve in the former being flat, and in the other convex, as well as by the inequality of the ears in the first-named species. It bears a considerable resemblance to a young *Avicula*, and shows the affinity which exists between that genus and the *Pectinidae*. The adults seem not to have the power of spinning a byssus, nor to have any occasion for it. Their solid shells can withstand a good deal of buffeting by the tide; if they were slighter, they would require the cable of a *Pinna* to hold them on their anchorage-ground. The substance of the shells is very durable. I have had some of the deep valves in frequent use during the last eighteen years, for scalloping oysters; and although they must have been baked in an oven at least five hundred times, they are as perfect and serviceable as ever. The prettiest specimens come from Dublin, Cork, and the Channel Isles. This species belongs to the genus *Vola* of Klein. The young is the *P. laevis* of Pennant and the older British conchologists.

P. Jacobaeus (the famous "pilgrim" scallop) was at one time erroneously supposed to be a native of these seas.

It is common in the Mediterranean and Cherbourg. It is distinguishable from the present species by the ribs of the lower valve being angular instead of rounded.

THE HAMMER-HEADED OYSTER.

We have now come to the twentieth family, the Aviculidæ, which contains *Avicula*, *Malleus*, *Meleagrina*, *Perna*, and *Pinna*. The shells of the sub-genus *Malleus* (hammer-headed oysters) have a rough resemblance to the implement from which they derive their name. The valves are nearly equal, blackish, and somewhat wrinkled on the exterior, often brilliantly naced in the interior. They are enlarged to the right and left of the hinge, forming prolongations on each side, which give them the fancied resemblance of a hammer-head (*Malleus vulgaris*). At the same time they grow in a direction opposite to the hinge, which gives an appearance something approaching the handle of the implement.

This is the first feature which a glance at *Malleus alba* conveys. The hinge is without teeth, having instead a deep conical fossette or dimple, for the reception of a very strong ligament, which acts upon the valves. The animal is contained in the interior of the shell, its mantle fringed by very small tentacular appendages. Only six actually living species of the genera are known, which are inhabitants of the Indian Ocean, of the Australian seas, and the Pacific Ocean. (a)

(a) . "The Ocean World," p. 362.

CHAPTER X.

RELATIVES OF THE OYSTER.

ANTIQUITY OF THE OYSTER AS AN ARTICLE OF FOOD—STRUCTURE OF THE GLOBE—FOSSIL OYSTERS—OYSTER BANKS OF GEORGIA—OYSTERS IN CHALK—SHELL-MOUNDS IN ENGLAND, SCOTLAND, IRELAND, AMERICA, FRANCE, CORSICA, &c.—SHIELD-BEARING ANIMALCULES—COMPARISON BETWEEN THE MICROSCOPE AND THE TELESCOPE.

“I WEIGH my words well when I assert, that the man who should know the true history of the bit of chalk which every carpenter carries about in his breeches-pocket, though ignorant of all other history, is likely, if he will think his knowledge out to its ultimate results, to have a truer, and therefore a better, conception of this wonderful universe, and of man’s relation to it, than the most learned student who is deep-read in the records of humanity and ignorant of those of Nature.”—“On a piece of Chalk,” Professor Huxley.

For centuries the oyster has held a prominent place amongst the delicacies of the table, in antiquity as well as in modern society. From the abundance of oyster-shells, together with flint knives and other stone implements, found in the “kitchen-middens” of Denmark, it is evident that the men of the stone-age consumed large quantities of this animal.

Though the Heralds' College contains immense and diversified records of the past, it has no vellum or parchment-roll relating to the silver-shell (oyster) family. And yet it is to be traced to a period so remote as to eclipse the ancestry of Britain's proudest peer. It may be well to take a rapid glance at its high descent.

Some of the theorists of the last century considered the earth to have been primarily a perfect mathematical sphere, without seas or islands, without valley, rock, or mountain, and therefore, as having "neither wrinkle, scar, nor fracture."

They did not perceive that what they deemed deformity was actually beauty, and no less conducive to the greatest utility. We owe our springs of water, our rivers, the stone and lime of our buildings, the metals so essential to arts and manufactures, the purity and salubriousness of our atmosphere, and the abundance of vegetable and animal life, to the condition in which we find the earth. Its crust, so to speak, consists of some thirty or forty strata of various thickness, spread out one over the other, resembling as many volumes piled on their flat sides, and yet arranging themselves into a very few grand groups.

The whole set, indeed, is nowhere displayed lying each on the other; yet their order of succession is sure and known, so that, while some are wanting in every locality, the order of position is never violated.

Still further: the strata do not lie over each other like the coats of an onion or of a bulbous root, but have been correctly compared to a vast number of wafers, irregularly formed, laid on a globe, patched upon each other in different sets as to thickness, and variously under-passing, out-cropping, and over-lapping.

Were, then, a mighty force below this surface to act on certain points, and along certain lines, the wafer-patches would be bent, broken, and have their edges often turned up, so that those of the lower ones would stand in some places over the higher ones that had been thus shattered. And, now, were a mass of melted matter, which had lain quietly beneath the lowest of the patches, to boil up, burst forth in many places, to raise the wafers, piercing them, finally hardening in fantastic shapes, and traversing over the upheaved and fractured outside, there would be another illustration of the state of the earth's surface.

Such is the origin of granitic and similar rocks. Boiling up, they gave rise to mountain ranges when they could not pierce through the resistance; but, when they could, cooling, and remaining as magnificent crags and summits. It is by following the broken edges or "outcroppings" of the strata, carefully and intelligently, through extensive tracts of country, that the series is disclosed from the crystalline rocks, on which the first or lower stratum rests, up to the last, lying immediately under the soil on which we live, rear our edifices, and gather the produce of our gardens and fields. (a)

The astronomer may find good reasons for ascribing the earth's form to the original fluidity of the mass, in times long antecedent to the first introduction of living beings into the planet; but the geologist must be content to regard the earliest monuments which it is his task to interpret, as belonging to a period when the crust had already acquired great solidity and thickness, probably as great as it now possesses, and when volcanic rocks, not essentially differing from those now produced, were formed

from time to time, the intensity of volcanic heat being neither greater nor less than it is now. (*b*)

The internal heat of the earth, the elevation and depression of its crust, its belchings forth of vapours, ashes, and lava, are its activities, in as strict a sense as are warmth and the movements and products of respiration the activities of an animal. The phenomena of the seasons, of the trade winds, of the Gulf-stream, are as much the results of the reaction between these inner activities and outward forces, as are the budding of the leaves in spring and their falling in autumn the effects of the interaction between the organization of a plant and the solar light and heat. (*c*)

It was, however, while certain mineral masses were in progress of formation, and yet soft, that they were replenished with the remains of animals which had lived in the waters. Vestiges of their skeletons, coverings, and shelly dwellings, are still discoverable. In the various strata, excepting the earliest two or three, such remains occur of organised creatures, in some instances vegetable, but principally animal. Even in the lowest beds they may have appeared; but they would doubtless have been destroyed by the heat communicated from below. Each system of strata has species which belong to itself;—a fact which stands among the most remarkable discoveries of modern times.

It may be safely assumed that (my) readers have a general conception of the nature of the objects to which the word “species” is applied; but it has, perhaps, occurred to few, even of those who are naturalists *ex*

(*b*) “Principles of Geology,” Sir Charles Lyell, vol. 2, p. 211.

(*c*) “Geological Reform.”—See Professor T. H. Huxley’s “Lay Sermons,” &c., p. 237.

professo, to reflect, that, as commonly employed, the term has a double sense, and denotes two very different orders of relations. When we call a group of animals, or of plants, a species, we may imply thereby, either that all these animals or plants have some common peculiarity of form or structure, or we may mean that they possess some common functional character. That part of biological science which deals with form and structure is called Morphology—that which concerns itself with function, Physiology (*d*)—so that we may conveniently speak of these two senses, or aspects, of “species”—the one as morphological, the other as physiological.

(*d*) “. . . . It remains that I should put before you what I understand to be the third phase of geological speculation—namely, EVOLUTIONISM.

“I shall not make what I have to say on this head clear, unless I diverge, or seem to diverge, for a while, from the path of my discourse, so far as to explain what I take to be the scope of geology itself. I conceive geology to be the history of the earth, in precisely the same sense as biology is the history of living beings; and I trust you will not think that I am overpowered by the influence of a dominant pursuit if I say that I trace a close analogy between these two histories.

“If I study a living being, under what heads does the knowledge I obtain fall? I can learn its structure, or what we call its ANATOMY, and its DEVELOPMENT, or the series of changes which it passes through to acquire its complete structure. Then I find that the living being has certain powers resulting from its own activities, and the interaction of these with the activities of other things—the knowledge of which is PHYSIOLOGY. Beyond this the living being has a position in space and time, which is its DISTRIBUTION. All these form the body of ascertainable facts which constitute the *status quo* of the living creature. But these facts have their causes; and the ascertainment of these causes is the doctrine of ÆTIOLOGY.

“If we consider what is knowable about the earth, we shall find that such earth-knowledge—if I may so translate the word geology—falls into the same categories.

Regarded from the former point of view, a species is nothing more than a kind of animal or plant, which is distinctly definable from all others, by certain constant, and not merely sexual, morphological peculiarities. Thus horses form a species, because the group of animals to which that name is applied is distinguished from all others in the world by the following constantly associated characters. They have—1. A vertebral column; 2. Mammæ; 3. A placental embryo; 4. Four legs; 5. A single well-developed toe in each foot provided with a hoof; 6. A bushy tail; and 7. Callosities on the inner sides of both the fore and the hind legs. The asses, again, form a distinct species, because, with the same characters, as far as the fifth in the above list, all asses have tufted tails, and have callosities only on the inner side of the fore legs. If animals were discovered having the general characters of the horse, but sometimes with callosities only on the fore legs, and more or less tufted tails; or animals having the general characters of the ass, but with more or less bushy tails, and sometimes with callosities on both pairs of legs, besides being intermediate in other respects—the two species would have to be merged into one. They could no longer be regarded as morphologically distinct species, for they would not be distinctly definable one from the other.

However bare and simple this definition of species may appear to be, we confidently appeal to all practical naturalists, whether zoologists, botanists, or palæontolo-

“What is termed stratigraphical geology is neither more nor less than the anatomy of the earth; and the history of the succession of the formations is the history of a succession of such anatomies, or corresponds with development, as distinct from generation.”—Professor T. H. Huxley, “Geological Reform,” “Lay Sermons,” pp. 236-7.

gists, to say if, in the vast majority of cases, they know, or mean to affirm, anything more of the group of animals or plants they so denominate than what has just been stated. Even the most decided advocates of the received doctrines respecting species admit this.

“I apprehend,” says Professor Owen, (e) “that few naturalists now-a-days, in describing and proposing a name for what they call ‘a new *species*,’ use the term to signify what was meant by it twenty or thirty years ago; that is, an originally distinct creation, maintaining its primitive distinction by obstructive generative peculiarities. The proposer of the new species now intends to state no more than he actually knows; as, for example, that the differences on which he founds the specific character are constant in individuals of both sexes, so far as observation has reached; and that they are not due to domestication or to artificially superinduced external circumstances, or to any outward influence within his cognizance; that the species is wild, or is such as it appears by Nature.”

If we consider, in fact, that by far the largest proportion of recorded existing species are known only by the study of their skins, or bones, or other lifeless exuviae; that we are acquainted with none, or next to none, of their physiological peculiarities, beyond those which can be deducted from their structure, or are open to cursory observation; and that we cannot hope to learn more of any of those extinct forms of life which now constitute no inconsiderable proportion of the known Flora and Fauna of the world: it is obvious that the definitions of these species can be only of a purely structural or morphological

(e) “On the Osteology of the Chimpanzees and Orangs”: Transactions of the Zoological Society, 1858.

character. It is probable that naturalists would have avoided much confusion of ideas if they had more frequently borne the necessary limitations of our knowledge in mind. But while it may safely be admitted that we are acquainted with only the morphological characters of the vast majority of species—the functional, or physiological, peculiarities of a few have been carefully investigated, and the result of that study forms a large and most interesting portion of the physiology of reproduction. (f)

Now it is an interesting fact, that with the substance of our globe shells have much to do. “Of all classes,” says Lyell, “the testacea are the most generally diffused in a fossil state, and may be called the medals principally employed by nature in recording the chronology of past events.” Lying upon and filling up depressions or basins of the chalk, is our great tertiary formation, including many tertiary shells, all apparently extinct. The most common shell is a massive gigantic oyster, sometimes over a foot in diameter. The beds comprising this formation are covered by others of a peculiar soft, white stone, including much gypsum, and resembling chalk, but really of the nature of pumice stone. This substance is very remarkable, from its being formed, to at least one-tenth of its bulk, of animalcules; and Professor Ehrenberg has recognised in it no fewer than thirty marine creatures.

Darwin describes the geology of Patagonia as worthy of attention. It differs from Europe, where the tertiary formation appears to have accumulated in the bays; for here, along hundreds of miles of coast, there is one great deposit, including many tertiary shells, all apparently

(f) “The Origin of Species,” “Lay Sermons,” &c., by Professor T. H. Huxley, pp. 258-60.

extinct. Here, too, the most common shell is an oyster of gigantic size.

In a Letter from Mr. Stanley, relative to the Emin Relief Expedition, that renowned Explorer, amongst other highly interesting matter, says:—"In favour of the river was also the certainty of obtaining food. Such a fine broad stream as this, we argued, would surely have settlements on its banks: the settlements will furnish food by fair means or force. The river retained a noble width—from 500 to 900 yards, with an island here and there, sometimes a group of islets, the resorts of oyster fishermen. Such piles of oyster shells! On one island I measured a heap 30 paces long, 12 feet wide at the base, and 4 feet high. . . . On the 9th of July we came to the rapids of Gwengweré, another populous district. Near here I saw a stratum of oyster shells covered with 3 feet of alluvial soil. How many scores of years have elapsed since the old aborigines fed on those bivalves? I should like to know, and what was the tribe's name, and where, if any exists, is the remnant?"

In the "Intellectual Observer," vol. 1, p. 483, is an account of an "Oyster-shell" island, by M. Aucapitaine, on the east coast of Corsica, composed of layers of shells, bearing some resemblance to the shell-mounds of St. Michel-en-l'Herm, in La Vendée. This island is formed of still-living species, and is between three and four hundred yards in circumference, the greatest elevation about thirty yards, and the mean elevation rather more than two yards above the level of the sea. The Romans are said by the fishermen to have deposited the shells of the oysters there, which they salted for exportation, but M. Aucapitaine does not believe in the artificial origin of the island.

According to M. Quatrefages, the shell-mounds of St. Michel-en-l'Herm are composed of oyster, mussel, and scallop shells, of the same species as those living now in the neighbouring seas. Many of them have their valves still connected by the ligament which forms the hinge, and they have not even changed colour. The three banks of St. Michel-en-l'Herm are about seven hundred and thirty yards in length, three hundred in width, and rise about ten to fifteen yards above the level of the surrounding marshes.

Buckland mentions a large heap of oyster-shells in Galway Bay, at a place called Creggauns; another south-west of Tyrone, and one at Ardfry Point. The Creggauns heap consists principally of the shells of the oyster, mussel, and common cockle, though the whelk, *Pecten varius* periwinkle, limpet, *Nassa reticulata*, *Helix nemoralis*, Trochus, and *Venerupis decussata* (*Tapes decussata*?), are also found in it. There are layers of wood-ashes and stones, apparently used as hearth-stones, showing the marks of having been subjected to fire, but no weapons. The heap occupies an irregular space of two hundred feet long and sixty feet wide, and ranges from six to eight feet deep. There are various traditions as to the age of the heaps, and it is said that ninety years ago a series of high tides cast up the heap of shells from adjoining beds. (*g*)

In an old kitchen-midden, in the Andaman Islands, close to the landing-place at Homfray's Ghât, Mount Augusta, the valves of oysters *Arcidae* and *Cyrenidae* are found in abundance; but the present race of Andamanese are stated by the author of "Jungle Life in India" not to eat oysters, which suggests the idea that possibly there

were different inhabitants of this portion of the island at some former period. St. Hilaire describes heaps of oyster and other shells, bordering the river Piriqui-assú, near Aldea Velha, which are without doubt kjokkenmøddings. Similar shell-heaps, or *Ostreiras*, as they are called in Brazil, are found on the coast of Sao Paulo, and on the Ilha do Governador, in the Bay of Rio. They often contain human remains, pottery, &c. (*h*).

At Castle Hill, near Newhaven, about eight miles from Brighton, immediately beneath the turf, is a regular sea-beach of oyster-shells, many feet in thickness, forming the summit of the chalk cliffs, one hundred and fifty feet above the level of the sea. Near Bromley in Kent, and Reading in Berkshire, similar accumulations of pebbles and oyster-shells are to be found. A layer of oyster-shells, with the valves separated, and exhibiting other marks of water transport, is found, moreover, in the Whitby lias, extending for many miles along the coast, and ten or twelve into the interior.

During ancient epochs, as we learn from the fossils of both tertiary and secondary strata, many more kinds of oysters lived within our area, and multiplied so as to rival the contents of any modern oyster-beds. In the tertiary system we have a subdivision that is worthy of notice: *eocene* implies that there will be found the dawn of species still existing; the *miocene* subdivision above contains more of the species now living, though extinct species still predominate; while in the *pliocene*, or upper division, extinct species decline, and species now living predominate.

The oysters of ancient times, like those of our own climate, formed by their accumulation banks, more or less

(*h*) "Scientific Results of Agassiz's Journey," by C. F. Hartt. Note.

extended, of strata, more or less thick and horizontal, in which the shells are still in the position they originally occupied, and almost without any admixture of foreign bodies. Even the bivalves, which live vertically sunk in sand or mud, must also form sorts of strata, because the individuals newly born are deposited by the parents above themselves, so that, sinking in the mud in proportion as they enlarge in bulk, they depress their parents and the oysters below them in succession, so as to remove them sufficiently from the surface of the soil, to prevent their receiving any water, the consequence of which is death. Then their shells, vertical while the animal was living, begin to incline by degrees, become horizontal, are filled with the substance in which they are sunk, resist the pressure of the accumulated strata, so as sometimes to remain perfectly entire, or, if not so, they are broken and crushed, and disposed in beds more or less free from every other shell, or even from any other foreign body. (*i*)

The sea-board of Georgia, one of the most southern of the United States of North America, cannot fail to arrest the attention of the observant traveller, and excite his admiration of what may be truly termed a natural phænomena on extensive scale, in the formation of its oyster-banks.

The land from the sea, for about the space of from twelve to eighteen miles, is completely alluvial, and in general consists of uncultivated marsh lands, through which an iron rod might be thrust to the distance of eighteen or twenty feet. A great number of large creeks and rivers are found meandering through these marshes, and, owing to the sinuosities, invariably resulting from running water, the bends of these rivers would, in a short

time, cut away the adjoining land to such an extent, as would make the whole sea-board a quagmire.

But it is a remarkable fact, that wherever the tide bends its force, its effects are counteracted by walls of living oysters, which grow upon each other from the beds of the rivers to the very verge of the banks. These animals are often found in bunches among the long grass, growing upon the surface of the soil. They are in such abundance, that a vessel of a hundred tons might load herself in three times her own length. These banks are the favourite resort of fish and birds, as well as of the raccoon and some other animals, who feed on oysters both by day and night. Bunches of them, sufficient to fill a bushel, are found matted, as it were, together; and the neighbouring inhabitants and labourers often light a fire on the marsh grass, roll a bunch of oysters upon it, and there enjoy these luxuries.

Marvellous is the difference between death and life. It is a fact open to general observation, that all the coasts of the land composed of mineral substances, dead shells, or other animal or vegetable productions in which life is extinct, are habitually wetted by the ocean waters. But it is not so palpable, except to the student of nature, that no production of the sea, or of any other water, is thus wetted while it continues in the living state. Vitality, and vitality alone, produces this difference. It occurs in all waters, indeed, however soft and limpid they may be, or however mixed with saline and other active substances; and the more such substances exist in the composition of any water, whether of the sea or of any other collection, the more completely are the living inhabitants of that water, whether vegetable or animal, protected against its action.

How then is this ? A mucous, or slimy substance, not easily described, has been provided, in which the surface of a living being is constantly bathed, so that it may suffer no injury from the macerating or decomposing influence which the water, whether salt or fresh, would otherwise exert. As water very speedily decomposes the greater number of organised substances after they are dead, so, apart from the defence, destruction would await the living. Even the most compact of the porcelain shells are invested during life with a kind of membrane, often of extreme tenuity, which possesses the same quality. Most curious, then, is the relation of the sea to a substance which can be wetted by its waters, and to one which cannot be wetted. The wettable substance finds its way to the shore by an obscure but very certain and constant kind of attraction ; while the substance which the water of the sea cannot wet has no such tendency to come on shore, but remains to perform its function in the water.

Of no consequence is it whether it is a marine plant or animal, or aquatic bird, which frequents the waters without habitually living in them ; for, if it is fitted by the Creator to live in the sea, there is no surface-action so long as it thus exists, and it has consequently no tendency towards the shore. But when either the plant or the animal dies, and ceases to employ its powers, including among the rest the production of the water-repelling mucus, it is immediately subjected to the action of the waters as a dead thing ; the action of the sea casting it on the shore, as having no longer any connection with that economy of life which has there its range.

Such is the cause of the vast accumulation of shells with which we meet on various spots, and on some of the

shores of the Channel Islands among the rest. This is also the reason why that sea-weed, which is so valuable in the Channel Islands, comes ashore in considerable quantities after those violent disturbances of the waters which have torn it from its natural situation as a living vegetable, and transferred it to those dead products which the sea invariably casts on the strand as of no further use. (*j*)

But our information relative to "Oyster-heaps" is not yet exhausted; many more could be specified, but I will not trespass upon the reader's patience longer than to notice two or three authentic records thereof.

At Wigwam Cove, Tierra del Fuego, piles of old shells, cockles, and oysters, often amounting to some tons in weight, were noticed by Dr. Darwin, which had at different periods formed the chief food of the inhabitants. (*k*)

These remind us of the so-called *kjokkenmöddings* (kitchen heaps) of Denmark, or shell-mounds, to which the attention of archæologists has been recently attracted in Northern Europe, and which consist of thousands of shells of the oyster, cockle, and other edible mollusks, with implements of stone, such as flint knives, hatchets, &c., and implements of bone, wood, and horn, with fragments of coarse pottery mixed with charcoal and cinders. (*l*)

I have already informed the reader that for the most part the offspring of the oyster remains near the mother, and I repeat it, in order to impress upon his mind and

(*j*) Mudie.

(*k*) Darwin's "Voyage of Adventure and Beagle," vol. 3, p. 234.

(*l*) Sir Charles Lyell's "Antiquity of Man."

memory the fact that this accounts for the large oyster banks or beds which are found in almost all the seas of the temperate and torrid zones, and which in some places have been known to attain such magnitude as to cause ships to be wrecked upon them. And, again, as the reader is aware, the lower stratum is necessarily lifeless, being pressed upon by the upper one, so that the oysters beneath are unable to open themselves, and are consequently deprived of food.

The immense propagation of the oyster may be understood from the fossil oyster bed near Reading, in Berkshire. These fossils have the entire shape, figure, and are of the same substance as our recent oyster shells, and yet must have lain there from time immemorial. This bed occupies about six acres, forming a stratum of about two feet in thickness. But the largest fossil oyster banks are those raised by earthquakes along the western shores of South America, which measure from sixty to eighty feet in depth, are often forty miles in length, and in many places stretch above two miles into the interior.

In 1863, Sir John Lubbock published, in the "Natural History Review," an account he had received from the Rev. G. Gordon, of Scotch kjökkenmöddings on the Elginshire coast, resembling those in Denmark. Mr. Gordon says: "By far the most striking, if not the most ancient, of the kjökkenmöddings we have in our vicinity, is that one which lies within a small wood on the old margin of the Loch of Spynie, and on a sort of promontory formed of those raised shingle beaches so well developed in that quarter. This mound, or rather two mounds (for there is an intervening portion of the ground which has no shells), must have been of considerable extent. A rough measurement gives eighty by thirty yards for the larger, and twenty-six by thirty for the smaller portion. The most

abundant shell is the periwinkle ; next in order as to frequency is the oyster, which, as well as those who had it as a large item in their bill of fare, has passed away from our coasts. Save in some of the nooks of our Firth, as at Cromarty, Altirtie, and Avoch, we know not where a small dish of them could be procured. As third in order, in this mound, is the mussel, and then the cockle."

Mr. Gordon further adds that similar refuse-heaps are found all round the shores of the Moray Firth, and that the farmers gradually cart them away to serve as manure or top dressings. These shell-mounds, Sir John Lubbock states, are actually called "shelly-meddings" by the fishermen of that district.

Cockle, mussel, and oyster shells, are often discovered in great quantities on the sites of Roman stations.

The following quotation may be considered not to be in strict accordance with the foregoing accounts of kjökkenmöddings, but the analogy is so close, and the information so interesting, that I have ventured to insert it here instead of its relative chapter.

In the "Report of the Commissioners of Fisheries in Maryland, January, 1880," is the following account of the oyster-fisheries in Chesapeake Bay, given by Mr. U. H. Brooks:—"The town of Crisfield, Maryland, is situated at the junction of the two sounds of Pokamoke and Tangier, two large and wide but shallow sheets of water, whose muddy bottoms abound in oysters of the best quality. The town is one of the most important centres of the oyster-packing industry, and is built in the water, upon the shells of the oysters which have been shipped to all parts

of the country for consumption. As fast as the oysters are opened the shells are used to build up new land, and with them a large peninsula has been formed, stretching out for more than half a mile from the low marshy shore towards the oyster-beds, and furnishing room for wide streets, a railroad, and a steamboat landing, in addition to the large packing-houses, and the shops and dwellings for a population of several thousand people. A single view of the long white solid streets and docks of this singular town would convey a much more vivid idea of the oyster-packing industry than any number of tables of statistics. At some future period this enormous accumulation of oyster-shells will be considered as a *kjökkenmödding*." (*m*)

It is a curious fact that one of the enigmas of geology is supposed by some to be solved by animals still found in the stomachs of living oysters. A paper on this subject was read in the year 1844, before the Microscopical Society, by the Rev. J. B. Read. The difficulty in question he thus states :—"It has been discovered, or rather asserted, that there is a break in the great geological chain of organised beings ; and that a link is wanting to connect the cretaceous and antecedent series with a series of subsequent formations." Accordingly, Sir Charles Lyell founded on this supposition his arrangement of the subdivision of the tertiary system ; his eocene period, or dawn of our present animal and vegetable kingdoms, being coincident with the third geological era. Dr. Mantell, however, had doubts on this subject, and, adopting Sir Charles's arrangement as useful in the present state of knowledge, he thought it might require to be

(*m*) "Report of the Commissioners of Fisheries of Maryland," 1880.

"Development of the American Oyster," by U. H. Brooks.

modified or even abandoned with the progress of research, as he remarks:—"It cannot be doubted that strata in which no recent species have been found may yield them to more accurate and extended observation."

"It is remarkable," says Mr. Read, "that the converse of this supposition has actually obtained, and our modern seas have yielded living forms hitherto characteristic of the chalk formation, and regarded as antediluvial. The merit of this discovery rests with Professor Ehrenberg. My own observations confirm all the important conclusions arrived at by Ehrenberg, and are, fortunately, capable of easy verification. It will not be necessary to send for sea mud from Norway, or for Peruvian or Mexican sea water; half a dozen native oysters, or, in truth, I may say, the stomach of a single oyster, will often afford us ample proof of the uniformity and identity of organic life in distant ages of the earth, and leave us in no doubt that the dawn of the organic creation, co-existent with ourselves, reaches further back into the history of the earth than has hitherto appeared."

Mr. Read then proceeds to state that the ciliary currents in the fringes of the oyster induced him to examine the stomach, under the expectation of finding some minute forms of infusoria, as it seemed but reasonable that the absence of locomotive power, and the consequent inability of seeking for food, might be compensated by so beautiful a contrivance for ensuring constant nourishment. His expectations were fulfilled and surpassed. In the stomach of every living oyster he examined, and in the intestinal canal, he found myriads of living animalcules. Not only were some of these of the naked kind, but others which have the silicious loricae (the flinty shields), and some of

those which, in their fossil state, constitute the chief bulk of the chalk. (*n*)

“Beyond all doubt,” adds Mr. Read, “the bulk of the cretaceous series is composed of organisms still living, as I have now shown, in our British seas, and, as Ehrenberg observes, still capable, under the occurrence of favourable circumstances, of giving rise to the greatest changes in the distribution of the solid crust of the earth. The material, and not the magnitude of the infusoria, is the proper element in these calculations. We must shut our eyes to the minuteness of each individual atom of life, and look rather at the marvellous activity of its law of increase, and at its indestructible shield, which sets at defiance the two great reducers of organic structures, death and fire. A very few nutshells would hold all we should leave of an elephant, if reduced to its ultimate elements by fire, but no known intensity of heat would reduce the silicious mass of infusoria. Fusion, under certain conditions, would be the

(*n*) The examination of a transparent slice gives a good notion of the manner in which the components of the chalk are arranged, and of their relative proportions. But by rubbing up some chalk with a brush in water, and then pouring off the milky fluid, so as to obtain sediments of different degrees of fineness, the granules and the minute rounded bodies may be pretty well separated from one another, and submitted to microscopic examination, either as opaque or as transparent objects. By combining the views obtained in these various methods, each of the rounded bodies may be proved to be a beautifully-constructed calcareous fabric, made up of a number of chambers, communicating freely with one another. The chambered bodies are of various forms. One of the commonest is something like a badly-grown raspberry, being formed of a number of nearly globular chambers of different sizes congregated together. It is called *Globigerina*, and some specimens of chalk consist of little else than *Globigerinæ* and granules.—“On a piece of Chalk,” a Lecture to Working-men, by Professor Huxley.

utmost result, and thence would originate other mountain masses which, to say the least, would be very nearly allied to those which we term granitic."

Surprising as it may be to many to find the shells of oysters largely contributing to the crust of the globe, it is still more so that creatures of extreme minuteness should be associated with them. The Egyptian pyramids are actually built of a limestone entirely composed of chambered shells, exquisitely constructed, and of very small size. Other rocks there are whose very substance consists of microscopic shells of extraordinary beauty, once the habitation of minute animals. No one who visits the county of Kent, for instance, can fail to observe the extension of the great chalk range, which again shows itself on the opposite coast of Boulogne. Above the chalk lies a deep bed of plastic clay, and above this the London clay, of which the hills of the Isle of Sheppey consist, and also Shooter's Hill, which is about four hundred and forty feet in height. Near Pegwell Bay, which is a pleasant walk from Ramsgate, this London clay immediately covers the chalk, spreading over a tract of no great extent. In some parts, as, for example, a strip from the valley of the Darent to below Gravesend, the overlying clays have been more or less completely washed away, the chalk being with a mixture of sand and vegetable soil. (o) "If all the points at which true chalk occurs were circumscribed, they would lie within an irregular oval about 3000 miles in long diameter—the area of which would be as great as that of Europe, and would many times exceed that of the largest existing inland sea, the Mediterranean."

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(o) "Adventures of an Oyster," p. 73.

The great mass of the chalk is composed, as we have seen, of the skeletons of the Globigerinæ, and other simple organisms, imbedded in granular matter. Here and there, however, this hardened mud of the ancient sea reveals the remains of higher animals which have lived and died, and left their hard parts in the mud, just as the oysters die and leave their shells behind them, in the mud of the present seas.

There are, at the present day, certain groups of animals which are never found in fresh waters, being unable to live anywhere but in the sea. Such are the corals; those corallines which are called Polyzoa; those creatures which fabricate the lamp-shells, and are called *Brachiopoda*; the pearly *Nautilus*, and all animals allied to it; and all the forms of sea-urchins and star-fishes.

Not only are all these creatures confined to salt water at the present day, but, so far as our records of the past go, the conditions of their existence have been the same; hence, their occurrence in any deposit is as strong evidence as can be obtained that that deposit was formed in the sea. Now the remains of animals of all the kinds which have been enumerated, occur in the chalk, in greater or less abundance; while not one of those forms of shell-fish which are characteristic of fresh water has yet been observed in it.

When we consider that the remains of more than three thousand distinct species of aquatic animals have been discovered among the fossils of the chalk, that the great majority of them are of such forms as are now met with only in the sea, and that there is no reason to believe that any one of them inhabited fresh water, the collateral evidence that the chalk represents an ancient sea-bottom

acquires as great force as the proof derived from the nature of the chalk itself. (*p*)

The extreme minuteness of the chalk animalcules is strikingly proved by the fact that, even in the finest levigated whiting, multitudes of them are still present, and may be applied, without suffering change, to the most varied purposes. Thus, in the chalk coating given to painted chambers, paper, or even glazed visiting cards, may be seen a pretty mosaic of well-preserved moss-coral animalcules, invisible to the naked eye. Our natural vision receives from such a surface the impression of the purest white; it is only the microscope that can disclose the fact, that it contains the bodies of millions of beings of exceedingly varied and beautiful forms that once enjoyed life. Similar relics are found in the series of the oolite and lias rocks, which come under the chalk, and, in England and many other countries, overlies the new red sandstone.

Another instance, too remarkable to be omitted, is that of the polishing slate of Bilin, in Bohemia, occupying a surface of great extent, probably the site of an ancient lake. Its slaty stratum, fourteen feet in thickness, consists almost entirely of an aggregation of silicious shields of one species of animalcule, *Gaillonella distans*. These shields, or cuirasses, as they have been called, are most beautiful coverings, sometimes of a single plate, sometimes double, formed of the purest quartz or rock crystal, and therefore perfectly transparent.

The size of one of these animalcules amounts, on an average, and in the greater part, to one two-hundred-and-eighty-eighth of a line, which equals one-sixth of the thickness of a human hair. The globule of the human

(*p*) "On a piece of Chalk," by Professor Huxley.

blood is not much smaller. Those of a frog are twice as large as one of these creatures. As the polishing slate has no cavities, these animalcules lie closely compressed. A cubic inch would contain, on an average, about forty-one thousand millions of these animals. Of the forty-one thousand millions of them, one hundred and eighty seven millions go to a grain. A single shield of the *Gaillonella* weighs about one-hundred-and-eighty-seven-millionth part of a grain.

An ingenious device has been adopted by a modern writer to cast light on immense numbers, of which it is ordinarily so difficult to conceive. He says, if a million of peas were placed on the floor of a room, it would require to be sixteen feet square. Accordingly, it would require one hundred and eighty-seven rooms, proportionately smaller, to contain the animalcules that would amount in weight to a single grain !

Ehrenberg calculated the fecundity or capacity of microscopic animals to be so great that one of these imperceptible animals can become, in four days, 170 billions, by germination or voluntary division. Many strata in the earth are formed entirely of the remains of infusoria, and a very familiar example is the Tripoli-powder, from the polishing slate of Bilin, in Bohemia. A single grain of Tripoli-powder contains no fewer than 187,000,000 of the transparent flinty skeletons of dead animalculæ ; yet the layers of the earth which are made up of them extend for miles. In the harbour of Wisenar, in the Baltic, they increase and multiply at a great rate, for 17,496 cubic feet of mud are formed there every year, and every grain of it contains 100,000,000 of the beautiful silicious remains of the infusoria. In the island of Barba-dos there is a thick mass of the most beautiful flinty sea

animalculæ, and they are in such numbers that it must be supposed that the dead minute animals were constantly falling in showers from the sea to the bottom.

With great truth and eloquence Dr. Chalmers has remarked, as he compared the microscope with the telescope:—

“The one led me to see a system in every star; the other leads me to see a world in every atom. The one taught me that this mighty globe, with the whole burden of its people and of its countries, is but a grain of sand on the high fields of immensity; the other teaches me that every grain of sand may harbour within it the tribes and the families of a busy population. The one told me of the insignificance of the world I tread upon; the other redeems it from all its insignificance; for it tells me that in the leaves of every forest, and in the flowers of every garden, and in the waters of every rivulet, there are worlds teeming with life, and numberless as are the glories of the firmament. The one suggests to me that within and beneath all that minuteness which the aided eye of man has been able to explore, there may yet be regions of invisibles; and that could we draw aside the mysterious curtain that veils it from our senses, we might there see a theatre of as many wonders as astronomy has unfolded, a universe within the compass of a point so small as to elude all the powers of the microscope; but where the wonder-working God finds room for the exercise of all His attributes, where He can raise another mechanism of worlds, and fill and animate them with all the evidences of His glory.”

CHAPTER XI.

PERILS OF THE OYSTER.

PERILS ATTENDANT ON ITS BIRTH—THE DREDGE—ENJOYMENTS OF THE OYSTER—"GREENING" OF THE OYSTER—NOT INSENSIBLE TO PAIN—THE STAR-FISH, NOTIONS OF THE ANCIENTS CONCERNING IT—HOW THE STAR-FISH OR SEA-STAR ATTACKS AND DEVOURS THE OYSTER—THE ECHINI OR "SEA-URCHINS"—THE WHELK—TINGLE—OYSTERS, THE PREY OF QUADRUPEDS—THE CRAB—THE OYSTER-CATCHER—SEA-WORMS—THE CLIONA—THE ROYSTON CROW—THE CARRION CROW—SAND AND FROST—THE ASTYRIS.

"Life maintains life. The death of one provides food and development to others, for all are bound up together ; all assist at the metamorphoses continually occurring in the organic as in the inorganic world, the result being general and profound harmony—harmony always worthy of admiration. The Creator alone is unchangeable, omnipotent, and permanent ; all else is transition."—*The Ocean World*, p. 57.

Violence produces violence, and antagonism antagonism, whether among animals or men ; but it is equally true that, in the absence of such qualities, there may be the endurance of malignant assaults, and of repeated and grievous injuries. The oyster, for example, lying on its

rocky bed, is free from all appearance of intruding on the comfort, much less the lives, of creatures in its neighbourhood ; it might be taken, indeed, as the very symbol of harmlessness ; but still there are many who endeavour to make it a prey.

Nor is this any peculiar condition ; wherever oysters are found they are beset by perils. Even from its very birth do its woes and its sorrows begin. Thus, . . . “at the time when all the adult individuals composing an oyster-bank give birth to their offspring, this living dust issues forth like a thick cloud, which, dispersing far from the spot whence it emanated, and scattered by the movements of the water, leaves upon the cultch (*souche*) only an imperceptible part of the produce ; all the rest disperses, and if these animalcules, wandering here and there by myriads, at the mercy of the waves, do not meet with something solid on which to fix themselves, their death is certain ; for those which have not become a prey to the inferior animals which feed on infusoria, end by falling into a medium unsuitable to their ulterior development, and often by being swallowed up by the mud.”—M. Coste, *Voyage d'Exploration*, p. 93.

Or, let us suppose the embryo mollusc to have escaped these dangers ; that it has found and attached itself to some solid body, or to the cultch prepared for its affixture, and further, let us suppose it to have attained a respectable size, and the age of twelve or sixteen months ; and, finally, let still the fancy of the reader follow me, and deem that we are in an oyster-boat. The sails are set, the dredge is sunk, and favouring winds swiftly speed the boat over the oyster zone !

Look ! from the dredge I have, at random, picked an oyster of twelve months growth. Observe how impas-

sively it lies upon the palm of my hand. Nay, do not glance at it so contemptuously, but think—think—O think what a glorious and immortal Sermon could be preached upon this living Text, could we but find a Poet-Preacher to expound it from the Laws of Nature as the Immortal Bard of Avon *might* have done had he known as much concerning it as what we since his time have learned. Think what he *might* and *could* have said thereon; *he* that could *feel*, and has said that—

“The poor beetle that we tread upon
In corp’ral sufferance feels a pang as great
As when a giant dies.” (a)

(a) I must not permit the reader to take the above quotation in the sense in which, apparently, it is put.

In “An Essay on the Beneficent Distribution of the Sense of Pain,” by G. A. Rowell (Oxford, 1857), that writer says:—“It is a very general opinion that death, under any circumstances, must be the cause of pain; and that even the smaller insects, when dying, are susceptible of pain in a high degree. Shakespeare is often quoted in support of this idea; and we are often told with great pathos, that

The poor beetle which we tread upon,
In corporal sufferance feels a pang as great
As when a giant dies.

Had Shakespeare written these lines in the sense in which they are usually quoted, he would have appeared as a very indifferent naturalist; but it is a libel on the memory of the great poet of nature so to quote them. The lines occur in *Measure for Measure*, in the scene where Isabella, in persuading her brother to submit to his fate with fortitude, says:—

The sense of death is most in apprehension;
And the poor beetle, &c.

It is evident that (taking the whole passage) Shakespeare’s meaning was, not that the pain of death in the beetle is great, but that it is little or nothing in man. And there can be no doubt that this is a correct view of the question; for, however painful the causes producing death may be, there are ample proofs that no actual pain occurs from death itself.”

What a world of beautiful expression and of moving sympathy for this humble Martyr of the Sea, bounded perhaps in a nutshell's space of heart-born eloquence, would that Master-Mind have jewelled in some undying Hymn to The Almighty Architect, who framed this Ocean's Mockery of Earthly Meekness! Note well how the small, weak, light, harmless, delicious-tasting creature, has locked the doors of its calcareous house, and that so securely that you cannot open them save with violence. How insignificant it looks!—this headless animal! Possessed of a nervous system of great simplicity, we cannot expect an oyster to be a highly-gifted animal; its sensibilities are obscure and its instincts limited; nevertheless, as has been well observed—

“The enjoyments even of the oyster are not so few and unvaried as on a first glance we might deem they were. Among the numberless happy creatures which crowd our world, the shell-fish, and the still more helpless ascidiæ, play, it is true, no obtrusive part, yet neither do they mar the scene by their deprivations. The performance of every function with which their Creator has endowed them, brings with it as much pleasure and happiness as their organisation admits of; in the gentle agitation of the water which floats around them, in its varied temperature, in the work of capturing their prey, in the imbibition and expulsion of the fluid necessary to respiration, &c., they will find both business and amusement; and in due season love visits even these phlegmatic things, whose ‘icy bosoms feel the secret fire.’”

But this imaginary young oyster of ours. What shall we do with it? Well, were we in English waters we should throw it back into its native element, and leave it to grow to edible maturity; but you will please to bear in

mind that we are in *French* waters, and, therefore, a different and a sadder fate awaits the poor mollusc—an evil destiny, to which, in comparison, its destruction by any one of its natural enemies is a mercy. What the nature of that fate is you shall learn, and, in order that the information may not be suspected to emanate from motives of national prejudice, I will give it you in the words of that distinguished French Naturalist, M. Moquin Tandon.

“Every quadruped and every bird, even if it find not a friend in man, yet has a protector from the cruelty of man in the Society for the Prevention of Cruelty to Animals. Perhaps it is that this admirable society finds that it has as much as it is able to do in looking after the interests of the terrestrial, without searching the world of the sea for fit objects over which to extend its protecting arm ; or it may be that the sufferings of the denizens of the sea, who have the misfortune to fall into the hands of the lords of creation, have never been brought under the society’s notice. But, so far as we know, no effort has ever been made to defend the marine inhabitants from the ill-treatment many of them receive. Let us, for example, tell the tale of the oyster’s woes.

“The dredge, with a violent wrench, tears them from their native rock. Lifted from the water, they are, especially in France, carried to ‘oyster parks’—long, canal-like excavations—filled with green, stagnant salt water. The green matter, which makes the water all but offensive, penetrates the systems of the poor molluscs compelled to inhale it. The oyster under this régime fattens, and soon attains that state of obesity so relished by the connoisseur, but which is really the result of disease induced by the unwholesome water of the park. Imagine the unspeakable

disgust of the bivalve, after living in the beautifully clear and fresh water of the ocean, at being immured in a stagnant pool, whose water is seldom changed, but always charged with filth.

“When the miserable creature has attained a livid green colour, it is fished up a second time—not, alas! to be returned to its native sea, but packed in a hamper—an ignoble prison-house, without door or window; with only as much of the life-giving water as it can contain between its tightly-closed valves, it is scarcely able to keep off asphyxia. As if they were inanimate merchandise, and not living creatures, they are dispatched by rail, tossed about from one van to another; and terribly shaken, they at length arrive at an oyster-shop.

“This is a critical moment for the unhappy bivalve. Thrown into a tub of clean water, its hopes are cruelly revived, and for a moment it fancies its tortures are at an end, and once more it is in the sea. If ever it possessed such thoughts, they are soon dissipated, as it finds itself taken for the third and last time out of its native element. It is now in pitiless hands—a blunt knife, in spite of its most strenuous efforts, is thrust between its valves, and with a horrible wrench its shells are forced asunder. The muscle by which they were closed is cut or rather jagged through, and the hinges are violently detached. It is now laid on a plate, exposed to every current of air, and in this state of suffering it is carried to the table. There the thoughtless being for whose pleasure it has suffered untold woes, powders it with the most pungent pepper, squeezes over its wounded and bleeding body the abomination of its race, the acrid vinegar; and then, alas! with a silver knife, which only jags, but cannot cut, he wounds and bruises it a second time; or, worse still, he saws and tears

and rends it from its remaining shell ; then he impales it with a three-pronged fork, and—*horribile dictu* !—still living and palpitating, he throws it into his mouth, where the teeth cut, and crush, and grind it.

“We have said that oysters have—in common with their family—neither head nor arms ; that they are without eyes, without ears, without nose ; they cannot move, they cannot cry. Quite true ; but all these negatives do not assert that they are insensible to pain. Two celebrated Germans, Brant and Ratzeburg, have shown that the oyster possesses a well-developed nervous system ; and if they have organs of sensation they must suffer. ‘Can an animal with nerves be impassive ?’ asks Voltaire. Can we suppose any such impossible contradiction in nature ?

“We hasten, however, to tranquillise the minds of the dredgers, the breeders, the sellers, and the consumers of the oysters ; and to excuse the indifference of the protecting societies ; for there is a great difference between a helpless, imperfect mollusc, and the higher class of animals. In the case of the former we swallow the whole animal, scarcely thinking of its animal nature. It is a denizen of another element ; it lives in a medium in which we cannot exist ; it presents itself in a form we may call degraded ; it has an obscure vitality, motions undecided, and habits scarcely discernible. We may, therefore, witness the oyster mutilated—mutilate it ourselves—crush it, and swallow it, without a passing pang, or yet a feeling of remorse, and without laying ourselves open to the charge of cruelty.

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“Following the example of the Romans, oysters are placed in reservoirs, where they grow larger and assume a

green tint. Is this why such oyster plantations are termed *parks*?

“At Marennes these reservoirs are called *claires*. They are inundated fields, which stretch on each side the banks of the Seudre for many miles. The *claires* of Marennes differ from the oyster parks of other localities in this—that while the parks are submerged by the rising waters of every tide, the *claires* are only covered at spring-tide.

“An oyster six or eight months old requires two years before it reaches the point of perfection; but it is very seldom that the oysters eaten in Paris undergo these conditions; generally the adult oyster is placed in the *claires*, and in a few days it begins to have the characteristic green tint. The green colour is not general, but is particularly shown in the region of the branchiæ, upon the labial feelers, and in the intestinal canal. What this colour is has long been a subject of conjecture. It certainly differs from all other colouring matters, and Berthelot has shown, by a chemical analysis, that it has some peculiarities. Some naturalists believe that it is produced by a disease of the liver, caused by the unnatural position of the oyster; certainly this would give a green hue to the parenchyma. Another opinion is, that the colour is from an accumulation of animalculæ, which are lodged in the tinted parts. Priestley suggests that it is the peculiar green colour which is generally produced in water exposed for a long time to the action of light; but the most probable solution of the difficulty appears to be that it is in some way due to the soil of the *claires*. The green molecules are arrested by the branchiæ, and thus the action of the organ is much impeded. The poor animal, injured in one of its essential parts, seems to dilate and become more tender, and for

this—its misfortune—is the more relished.”—*The World of the Sea*.

The enemies to whose attacks oysters are liable may be divided into animate and inanimate. Of the former, the star-fish, “five-fingers,” or “devil-fish,” is the most serious foe. The fact was well known to the ancients, though the mode by which the echinoderm is able to get at the inside of the mollusc was not understood by the worthies of classic times.

“The prickly *star* creeps on with like deceit,
To force the oyster from his close retreat.
When gaping lids their widen’d void display
The watchful *star* thrusts in a pointed ray,
Of all its treasure spoils the rifled case,
And empty shells the sandy hillocks grace.” (b)

So imagined Oppian and Ælian. It is strange that it did not strike these two classical worthies that the intruding finger of the star-fish must have been squeezed off by the pressure of the oyster-valves, for the readiness with which those echinoderms part with their limbs is notorious to the most superficial observer of nature. But we know better. Yes, we smile at the easy, childish credulity of the ancients with regard to this and many other things, but, after all, we must not boast too loudly, for it is but a brief time since we of the 19th century have become enlightened upon the subject in question. Let us hear what the late Frank Buckland remarks relatively. (c)

“The arch-enemy of the poor, harmless, innocent oyster, is the ‘five-finger,’ in ordinary language the ‘star-

(b) Oppian.—Halieut 2, 180-185, Ed. Schneider. Jones’ Translation, p. 75.

Ælian (and others) (Nat. Hist., 9, 22) has given precisely the same story.

(c) “Oyster Enemies.” In *Land and Water Journal*, vol. 1.

fish.' This is the creature which we pick up so frequently on the sea-shore, and which then looks so excessively stupid and harmless that it is difficult to imagine that it is a dire enemy to the oyster proprietor. Five-fingers have a power of locomotion, and they will come suddenly, from no one knows where, and, settling down upon the oyster-beds, devour them all, save the shells—just as a flock of wood-pigeons will settle in a body on a field where their food exists, or lady-birds will pitch in swarms on the hops, and eat up all the green insects (*aphides*) which they find upon the plants. I know at this moment (May 5, 1866), where an oyster-bed is situated on the north side of the Thames, and when the happy owner goes to look at his property, he will find nothing but tons of five-fingers and 'clocks,' or empty oyster-shells, but no oysters for the market."

It was for a long time a question amongst naturalists how so comparatively powerless a creature as a star-fish can destroy an oyster, which he certainly cannot swallow.

Before answering that question I must ask the reader's indulgence for my digression in giving a brief description of the creature mentioned. The name star-fish, though often applied, is erroneous: it should be sea-star, or *asteria*; and, as I have already shown, it attracted attention from the earliest times. Aristotle and Pliny named them *stellæ marinæ*, from their resemblance to the pictured form of the stars of heaven. The ancient naturalists asserted that sea-stars were so hot that they could consume all they touched; and Aldrovandus and Albertus declared that whatever they were brought in contact with they *cooked*; but, as usual, they advanced no proof. Others have affirmed that the sea-stars sting and blister the fingers when touched: a notion which probably led to their receiv-

ing the strange name of "Devil's-fingers." As Dr. Drummond was drying some in his garden, at Bangor, in the county of Down, he heard some children on the other side of the hedge exclaim, "What is the gentleman ganging to do with the bad man's hands? Is he ganging to eat the bad man's hands, do you think?"

Now such a superstition is not surprising, when no less a person than Hippocrates, and some of his successors, considered sea-stars to be a cure for hysteria and epilepsy, when taken in a decoction of brassica and sweet wine. But it would be difficult, if not impossible, to establish the stinging power of these creatures. Certain it is, that Professor E. Forbes declares that he has handled thousands of them without suffering the slightest irritation of the skin; and in this experience that of every naturalist we have known or heard of fully coincides. (*d*)

The star-fishes are animals without vertebræ: they are generally flattened and pentagonal, the branches being nearly equal to each other and arranged symmetrically as rays. These rays are more or less triangular, and are invariably five in number. Their ordinary figure excited the inquiry of Sir Thomas Brown:—

"Why, among sea-stars, nature chiefly delighteth in five points?" And again: "By the same number (five) doth nature divide the circle of the sea-star, and in that order and number disposeth those elegant semicircles or dental sockets and eggs in the sea-hedge-hog."

Without indulging in such curious speculations, the reader will find abundant materials of interest in the examination of a sea-star. But, perhaps, the best answer that

(*d*) "Silver-Shell; or, The Adventures of an Oyster," p. 129.

we can give—at least the nearest approaching to a solution of Sir Thomas Brown's problem, is in the wise observation of M. Moquin Tandon, that—

“The organisation of marine animals is far from being rigorously exact. The creative power seldom or never employed lines perfectly straight; the preference was always given to curved and wavy lines; hence the asterias are not constructed with exact geometrical accuracy.” The asterias are peculiar to the sea; they have no fresh water representatives. In fact, if a sea-star be dropped into fresh water it will act as a poison, and the animal will instantly die. Certain species are extremely common and numerous—so numerous, indeed, that the sea-board population cart them away to manure the land.

“The star-fishes are variously coloured. Some are a greyish yellow, some an orange yellow, others a dull red, or a violet. Their bodies are surrounded by a calcareous envelope, composed of pieces placed side by side, united by fibres. These plates are armed with tubercles and pricks; M. Gaudry found more than 11,000 of them on a red star-fish—that species which is most common in Europe. The asterias have a mouth at the centre of their lower surface. There are also upon this under surface globular drop-like protuberances, which are furnished with arm-like appendages; and it is from the globular projections that the organs are put forth, which are really the feet of the creature. These form a double or quadruple row; they consist of a fleshy cylinder of a greyish colour, and in most cases are terminated by a little globular vesicle filled with a watery liquid. This vessel is capable of great extension. When the creature wishes to push out its foot, it causes the globular vessel to contract; this

forces the liquid into the cylinder, which is consequently stiffened, and can be used for the purpose of locomotion. When the pressure upon the bag of fluid is relieved, the water returns back to its receptacle, and the cylinder becomes limp and contracts. In spite of the great number of these ambulacral organs, the star-fish does not move any quicker than other inhabitants of salt water, which possess only one foot or none at all.

“The mouth of this creature opens immediately into the stomach, which is a large sac, from which a chamber passes into each arm. These prolongations of the stomach are in reality intestines. Star-fishes are very voracious. They engulf their prey while still living, in a single morsel, and the flesh of them is poisonous.”

That the asteria plays an important part as the scavenger of the sea ; that he loves all kinds of dead flesh, and shows a wondrous activity in discovering and devouring it, we know ; that he can have no difficulty in devouring, whole, small crustacea and molluscs, we also know ; but how, in the name of wonder ! does the star-fish get at the dainty morsel so firmly locked in the ostrean larder ?

There are more ways than one of eating an oyster, and the mode adopted by the echinoderm forms a most strange and wonderful illustration thereof. Its mode of proceeding is thus graphically described by the late renowned naturalist, the Rev. J. G. Wood (*Longman's Magazine*, June, 1889).

“No one would have thought, on placing an oyster and a five-finger side by side, that the star-fish was a relentless foe to the oyster. Those who can remember their first fruitless endeavours to open an oyster may naturally wonder how the star-fish can achieve such a feat. As I have

repeatedly seen, it proceeds as follows : clasping the oyster in its rays, it brings its mouth opposite the hinges. From the mouth it pours a secretion which paralyses the hinge-muscle, and causes the shell to open. It cannot, like a dog whelk, extract its prey and put it into its stomach, so it reverses the process, and puts its stomach into, or rather over, the oyster, protruding the stomach from its mouth, surrounding the oyster with its coats, digesting it, and then withdrawing the stomach into its body. The wildest fancy of Oriental legends never equalled in grotesque imagination this perfectly true history of the oyster and the star-fish."

But although the star-fish can, in this extraordinary manner, manage to devour an oyster as big as himself, it must evidently be somewhat troublesome to him, for he prefers to attack oyster-beds covered with "spat," "brood," or "half-ware"—that is, oysters from one to three years of age—whose shells are not so hard and whose flesh is more delicate and pleasing to the echinodermal stomach.

Star-fish will also feed on mussels, which themselves destroy oysters by smothering them, and on whelk-tingles, dead crabs, barnacles, &c. ; "so that after all they may do some good, as a certain amount of vermin in a game preserve is anything but injurious to the welfare of the whole population ; the vermin keep up the balance of nature by destroying and eating the sick and weakly animals, which might otherwise die a lingering death."

But it is not every species of star-fish that is accounted guilty of oyster destruction ; of these are, notably, the sun-star (*Solaster papposa*), the sand-star (*Ophiura*), and the brittle-star (*Ophiocoma*), all which are so well known to every dredger. The next on the list of the oyster's ene-

mies is the Echini, "sea-eggs," "sea-urchins," whose well known empty cases are so common on every shore. The Echini, in form, may be likened to melons, and, although differing so much from the asterias, yet belong to the same class—the Echinoderms. The body of the sea-urchin consists essentially of an exterior shell, or solid corona covered with spines, and invested in a delicate membrane furnished with vibratile cilia. This corona is formed of an assemblage of contiguous polygonal plates, adhering together by their edges. The plates are so arranged that the shell is divided into vertical zones—hence its resemblance to the melon. These zones are of two kinds, one being very much larger than the other; the plates of the larger zones are covered with sharp spines, which are movable, and serve at once for protection and locomotion. The plates of the smaller zones are pierced with pores, from which issue filaments, by which the animal breathes and walks.

"It can travel either on its back or stomach. Whatever their posture, they have always a certain number of feet which carry them, and suckers with which they attach themselves. In certain circumstances the animal walks by turning upon itself, like a wheel in motion." (*e*)

"Nothing is more curious than to see a sea-urchin walk upon smooth sand. But for its colour, it might be mistaken for a chestnut with its bristling envelope, the spines serving as feet to put the little round prickly mass in motion. They have even been observed to make very considerable progress under these circumstances. One of the most singular organs of this interesting animal is its mouth. It is most curious. Placed underneath the body,

it occupies the centre of a soft space invested with a thick resisting membrane ; it opens and shuts incessantly, showing five sharp teeth projecting from the surface, the edges meeting at a point, supported and protected by a very complicated framework, which has received the name of Aristotle's Lantern. To this formidable mouth is attached an œsophagus or gullet, and an intestine which extends along the interior walls of the corona, describing the circumference of its principal contour. The food of the Echinidæ is still imperfectly known ; nevertheless, from the presence of shells, fragments of coral, crustaceans, and even other Echinodermata in their intestinal tube, it is to be inferred that a certain number of them at least are carnivores, or flesh-eaters, while others are supposed on the same evidence to be vegetarians." (f)

That the Echini are to be regarded as vermin, in the oyster-parcs, has been proved by the following evidence. In the month of May of a certain year, a sudden inroad of these sea-urchins was discovered in the Paglesham fishery, and by the month of August of that year they had eaten an enormous quantity of oyster the size of a split pea. Frank Buckland noticed several of these creatures on the oyster-beds in Kilkerran Bay, near Ballynahinch, Galway, and naïvely remarks that "they were not there for nothing."

Another supposed enemy of the oyster is the crab, which is too well known to need description here. This animal is certainly grotesque enough and most amusing in its habits ; it has been supposed to be an oyster enemy by

(f) "The Ocean World."

For further information relative to this interesting creature see the above-named work.

some persons, but Buckland is inclined to proclaim them innocent of the great offence. "I don't see," he says, "how a crab has the power of killing a live oyster—his nature and office is that of a scavenger. When, therefore, the oyster has been killed and opened by whelk-tingle or a five-finger, the crab will come, like a vulture to a dead camel, to claim his share of the prize."

All visitors to the sea-side who may have been bitten with the aquarium mania must be familiar with those white or brown spiral univalves, which may be seen in immense numbers sticking to the rocks from which the tide has receded. These are the molluscs popularly known as "dog-whelks" or "whelk-tingles." The animal is the *Purpura lapillus* of conchologists. It is extremely injurious to oysters and destroys vast numbers. Frank Buckland says of them :—

"These whelk-tingles seem to find in a short space of time where the oysters may be found in numbers ; for my friend, Mr. Browning, tells me that not very long ago some fishermen found a bed of oysters out in the mid-channel deep sea. These oysters were, at the time when they were found, not large enough to be dredged up and taken away to lay down on private beds, so the dredgers determined to leave them till they grew to the proper size. They had not, however, calculated upon the whelk-tingle, for these rascals, soon after the departure of the fishermen, found out the bed as well as the fishermen, and were there before them, killing every one of the oysters, leaving only the 'clocks,' or empty shells ; and when the dredgermen came next year to take up the oysters, they found nothing but whelk-tingles and five-fingers, and *no* oysters. Rewards are offered by the oyster proprietors for these whelk-tingles ; they pay a shilling a bucket for them."

The whelk-tingle gets at the meat of the oyster by boring the shell with his sharp tongue, which causes the mollusc to open its valves.

Buckland wisely recommends that the capsular nidamenta of these molluscs—so abundant on rocks near low-water mark, and so easily secured—should be gathered and destroyed.

Wherever oysters are found they are beset by perils. Thus, in Africa and other parts of the world where monkeys abound, one of these animals has been seen to place a stone between the two valves of an oyster-shell, and then securely to drag forth the little victim. Dampier observed another device practised by some poacher monkeys: these creatures took up oysters from the beach, laid them on stones, and beat them with another until the shells were demolished.

La Loubère states that the monkeys of the Cape of Good Hope amuse themselves by transporting shells from the shore to the mountain-tops, where they devour the contents at their leisure.

Even the fox, pressed by hunger, will eat oysters, and the raccoon, when near the shore, eagerly devours them.

Cunningham (*g*) says this creature watches for the opening of the shells, and then, putting in its paw, tears out the in-dwellers.

Barrow states in his account of the Cape, that there is scarcely a sheltered cavern in the sides of the Table Mountain, rising immediately from the sea, where living molluscs may not be found on any day of the year. Hither therefore crows, vultures, and aquatic birds come, detach oysters and similar creatures from the rocks, mount with them in

(*g*) "New South Wales."

the air, and letting them fall, secure them as a prey. The story of the bald head of Æschylus being mistaken for a stone by an eagle, who cracked the tortoise by its fall, but killed the poet, is not, therefore, altogether a fable. "In a cavern at Muswell Bay," says Barrow, "I distinguished some thousands of birds, and found as many thousands of living shell-fish scattered on the surface of a heap of shells, that, for aught I know, might have filled many thousand waggons."

Another of the oyster's enemies is a bird, which delights in the rocks, and reefs, and naked strands. When the sea rises it retires before the ebb, and then follows the reflux, groping in the sand for various marine animals, among which are oysters, its special favourites. From this circumstance it is called the oyster-catcher, and fully is it entitled to its name.

So well adapted is its bill not only to raise the limpet from the rock, but to force open the valves of the oyster, as to lead Derham long since to remark :—"The Author of Nature seems to have framed it peculiarly for that use." And it is not merely interesting, but instructive, to watch a bird of this kind detaching the oyster from its rocky bed ; digging up cockles with its powerful bill ; and separating mussels from the scarps. If the creatures are small, the oyster-catcher swallows them whole ; but if it finds one too large to be disposed of at once, the bird digs away at its valves till it opens them, and then, devouring the little animal, leaves its shell on the shore.

But there are other enemies of these creatures. Such are the sea-worms, some of which are of great beauty, which bore through the oyster-shell at all points. Here, then, is a very remarkable process, which may naturally give rise to the question—"How can a soft-bodied sea-

worm bore through so hard a substance as an oyster-shell?" and the mode adopted is well worthy of notice. There is reason to believe that sea-worms accomplish this task by means of flinty teeth, which stud their ribbon-shaped tongues. They must be actually beheld in order to excite due admiration. We cannot construct a model of them, even of a much larger size; for how can we imitate the life with which they are endowed, or the instinct that regulates their movements? These microscopic teeth are beautiful objects; withal constant in their shape, and arranged in transverse rows on the tongue.

Frequently the oyster will resist the invasion of the enemy by depositing some pearly matter between its tender body and the mouth of the invader, and thus compel him to beat a retreat. But others are not so fortunate; for in the holes drilled by the sea-worms a preparation is often made for the assaults of a parasitical sponge, which insinuates itself and eats further than its predecessor into the oyster, causing the softer parts of the shell to rot away, and spreading through the whole substance of the oyster like a dry rot in wood, until vitality is destroyed and its loosened shell becomes detached and empty on the waters.

Such is the *Cliona*, of which Mr. Hancock has determined upwards of fifty species, all inhabiting more or less diversified chambers in calcareous substances; three or four of which are found in the common oyster. Of these twelve belong to the British seas; the rest exist in various parts of the world. They are most numerous in warm climates; none have been yet procured from the polar regions.

On the coast of Northumberland the surface of almost every piece of limestone near low-water mark is riddled by

cliona; old shells, whether univalves or bivalves, are filled with it. "I have seen," says that intelligent observer, "half-grown living oysters with cliona extending from the umbones almost to the ventral margin, and in one or two instances it even reaches that margin"

In these cases it is evident that the growth of the sponge must have been more rapid than that of the shell, for the work of destruction could not commence until the oyster had attained to some size; and had its growth been even equal to that of the sponge, the shell ought to have reached its full development before the sponge had gained the lower margin.

Only let this creature commence its attack, and it pauses not until it has acted throughout the entire substance. Before long the middle portion is almost completely excavated, and only small pieces remain to divide the chambers that have been formed. As, however, in the working of Thames Tunnel, there was "a shield" for the defence of the miners, so the parasite leaves a thin plate on the outer and inner surfaces for its protection.

Yet this serves only for a time; numerous circular holes are ultimately drilled in these plates, which are the only indication of the work of destruction beneath, until some slight force from without ruptures the protecting walls, or the increasing growth of the tenant bursts them asunder. The whole system of elaborately wrought chambers, becoming exposed, soon gives way, and the cliona, Samson-like, perishes amidst the ruin produced by its own energy.

The question naturally arises, How can such cavities be produced? Evidently by some instrument with which it is provided, like the whelk, which with its proboscis can bore holes in shells, or by a solvent. On this point Mr.

Hancock remarks:—"The extreme simplicity of the organic structure of these beings forbids a belief in the existence of a special secreting apparatus. If, therefore, a solvent fluid be the agent, it must be supposed to exude from the entire surface of this humble animal. The character of the excavations would also lead to the same conclusion; for it is evident that the form of the sponge is influential in determining that of the chambers it inhabits. The test, then, can be easily applied, and, were the secretion of an acid nature, there could be little difficulty, one would think, in detecting it, particularly as *cliona* appears to work perpetually, at least so long as it continues to grow. I have completely failed, however, in detecting an acid." The calcareous particles, which may generally be observed strewed along the branched channels in the shell of the oyster, when inhabited by *cliona*, afford, as Mr. Hancock observes, a pretty strong proof of mechanical agency.

This, however, he proceeds, I think satisfactorily, to describe; for, if a portion of the superficial covering of the animal be carefully removed, and placed between plates of glass, with the external surface uppermost, and treated with strong nitric acid, large crystalline bodies of a peculiar character are scattered over it. These bodies are of a pale straw colour, and of the most brilliant lustre and gem-like beauty, the largest measuring one six-hundredth of an inch across. They are mostly irregularly six-sided, depressed, and scale-like, but stout, and frequently thickened in the centre, the upper surface being covered with numerous elevated, lozenge-shaped points, each generally having an expanded base, of a squarish form, slightly raised above the common surface.

These bodies are frequently congregated into groups, and are occasionally placed together side by side. Strong nitric acid does not in the least affect them after many days' immersion, the sharp angularity of the elevated points remaining unimpaired, and their brilliancy undiminished. From these facts, and from the manner in which these bodies reflect light, there can be little doubt that they are composed of silex, or of some other substance equally dense.

Nor is this all ; other crystalline bodies crowd the surface, which are as brilliant as the former, and, like them, resist strong nitric acid. These are mostly minute, being generally one six-thousandth of an inch wide ; they vary, however, considerably in size, and are occasionally very much larger ; they are mostly angulated, having an expanded scale-like base, and much resemble the lozenge-shaped points of the larger bodies. These smaller ones are crowded together into dense masses ; occasionally they become united by their expanded bases, and then the mass has a considerable resemblance to the larger forms.

All, then, that is required, is that each granule, or cluster of granules, should be set in motion ; nor would anything more than limited action be necessary. The motion of cilia, according to Ehrenberg, is produced by the contractile tissue on which they are based ; and if the silicious bodies now described are connected with a similar tissue, the whole surface of the sponge would be composed of thousands of minute drills, quite able to cut into the hardest calcareous substances. (*h*)

Amongst birds, besides the oyster-catcher, the Royston crow and the carrion crow have the character of destroying oysters.

(*h*) "Annals of Nat. Hist.," 2nd series, vol. 3, pp. 321-348.

Amongst the inanimate enemies of oysters, Frank Buckland makes special mention of sand and frost :—

“Of all the inanimate objects which are inimical to the oyster, there is nothing more fatal than sand. If we consider the highly sensitive and delicate structure of the oyster, it will be easily seen how very obnoxious sand would be to his welfare. The worst of sand is, that it is very liable to shift about in the sea, and great sandstorms not infrequently occur, just as they do in the deserts of Arabia, destroying suddenly whole caravans of camels and men. When I was at the Isle of Ré, Dr. Kemmerer gave me a famous instance of a large number of oysters being destroyed by sand. This event happened at a place called Morique. . . . There were a great number of tiles laid down at this spot, and there were besides a large number of oysters naturally adherent to the rocks. Just outside, however, there was a moving sandbank. The oyster-spat had taken well both on the tiles and on the stones, but during a storm the waves brought a quantity of sand, ruined the whole bed, and killed every oyster. . . . Although sand in large quantities is very dangerous for oysters, yet a certain quantity is by no means prejudicial to their welfare. The admixture should amount to what my friends at Ré call ‘sable vaseux,’ or mud sand. This ‘sable vaseux’ is very good for oysters, but it requires an experienced eye to know it when they see it.”

Sand destroys oysters either by smothering them *en masse*, or by getting between the shells near the hinge where the oyster cannot get rid of it. Frost, ice, and snow are destructive to oysters, but Buckland is of opinion that in all ordinary frosts, where the oysters are covered with three or four feet of water, they are safe.

Another enemy of the oyster, particularly when young, is the *ASTYRIS*, discovered in Chesapeake Bay, near Crisfield, Md., and described by Mr. U. H. Dall, of the United States Coast and Geodetic Survey, in the Report for 1881, as follows:—

“Only a few specimens were preserved, and hence it is impossible to speak positively in regard to its distinctness from the allied forms *Astyrís spirantha* (Rav.), and *A. lunata*, Dall (Ex. Say). It differs from the former, so far as the specimens go, in colour, pattern, and solidity, having also more whorls and a more slender form. It differs in form very much from southern specimens of *A. lunata*, but more specimens of each are needed to determine the limits of variation in these small shells. They belong to a group known to be extremely variable. It may for the present be denominated by the varietal name *Astyrís*, var. *Winslovii*, in commemoration of its discoverer (Lieutenant Winslow). Though known to be carnivorous, no species of the genus *Astyrís* has been recorded until now as an injurious animal.” (i)

In the same Report, (j) Lieutenant Winslow says:—
“During the season of 1878 we observed large numbers of *astyrís* in the shells of the mature oysters, and attached to those of the young. In many cases they were found in the holes which had been bored in the shells of the latter. As we could not find any known enemy of the oyster in sufficient numbers to account for the evident damage done, and as so many circumstances pointed to *astyrís* as the cause, I concluded that the boring must be done by that animal, and alluded to it in my previous report. . . .
During the past summer we have found a much larger

number of the rough whelks (*urosalpinx cinereus*) than during the previous season, and though they were not found in as large numbers as the *astyris*, yet their presence inclined me to question the conclusions arrived at during the season of 1878. I accordingly collected a large number of *astyris*, and placed them in an aquarium jar with a number of young oysters, changing the water constantly and inspecting the animals frequently. The observations were continued over a week, and at the end of that time both oysters and *astyris* were alive, but there was no evidence of any boring, nor did any inspection show an inclination in that direction upon the part of the *astyris*; on the contrary, they soon left the shells and went to the bottom of the jar. I then collected a number of *urosalpinx cinereus*, and subjected them to the same test. At the end of four days one oyster had been bored, and one whelk was found at work on the shell of another. The rough whelk is known to do great injury to the oyster in Long Island Sound, and the destruction of the young, alluded to in my previous reports as due to the drills, may be effected by this animal. That large numbers are destroyed by the whelks cannot be doubted; but as it is possible that the *astyris* may also assist in this destruction, a more extended investigation of this question than I was enabled to make is desirable."



CHAPTER XII.

THE OYSTER IN SEASON.

THE R. CANON CORRECT—PROFITABLE INVESTMENT—BILLINGSGATE
AND LONDON CONSUMPTION—ENGLISH OYSTER-BEDS—JERSEY
OYSTERS—FRENCH OYSTER-BEDS ON THE COAST OF BRITTANY
—OYSTERS NOT EATABLE IN JULY—STORY OF THE “GROTTO”
—GEORGE IV.’S “ACT.”

I HAVE oftentimes been told that it is a mere question of fastidiousness, or fashion, that oysters should be served for human food only at a certain fixed period of the year—

“Those four sad months wherein is mute
That one mysterious letter that has power
To call the oyster from the vasty deep,”

—those months possessing the letter *r* being proverbially the only months when the oyster is fit for human food.

Why not, such reasoners have said, eat oysters all the year round? Life is short. Why not obtain the first of gastronomical enjoyments every month of the year and every day of the month? I can in no manner go with these opinions, either from my practical knowledge of the oyster or from any just reasoning. (*a*)

Everyone is familiar with the saying that oysters ought only to be eaten in the months which have an *r* in them—

(*a*) “The Oyster,” &c.

it being generally supposed that they are unwholesome as food at other times. This opinion was held by oyster-eaters in the middle ages, according to the old Latin line :

“Mensibus erratis vos ostrea manducatis.”

In “Poor Robin’s Almanack,” 1719, under *September*, he says :—

“This month hath gotten an *r* in ’t,
By which Astrologers do hint
That the fish icleped oysters
Are in their operative moistures,
Which tho’ counted ungodly meat,
Because without grace they are eat,
And also uncharitable
’Cause naught but shells come from table,
Whereby the Poor small comfort gain,
Yet this for Truth I will maintain,
That with a glass of good Canary,
(Oh ! which to drink too much be chary ;)
Being wash’d down, I say, with sack,
No commendations they need lack !”

As a general rule, oysters are not in perfection between the months of May and August, though the impatience of the public has claimed the last-named month as an oyster month, and the 5th of August begins the season. “I am aware,” says the author of “The Oyster,” &c., “that in our good city of London, in the hottest and earliest days of August, oysters are gulped down by the thousand : it is, nevertheless, an error—a revolting, unhealthy, unclean error—which ought to be denied, both at home and abroad, by the strong hand of the law. I, for my part, utterly and entirely ignore fish or fowl of the game species, as fit for human food, during the seasons of breeding ; and although an oyster may be eatable in August, if the month be hot it is rarely fresh ; and what is more disgusting or

more likely to be injurious to man than a stale oyster? That which I have said . . . will, I hope, induce those who have hitherto broken through a rule strictly adhered to by all gastronomers, to abstain in future; and those who have hitherto enjoyed oyster-eating, fearlessly to eat on, and secure the first and foremost of all gastronomical indulgences provided for man—only in due season.”

It is certain, however, that much difference as to time of spawning and consequent fitness for food is to be found amongst oysters. The large oysters, so commonly hawked about on the shores near large towns, are often in excellent condition in the month of May.

The common Colchester and Faversham oysters are brought to market on the 5th August. They are called *Common* oysters, and are picked up on the French coast, and then transferred to those beds; the Milton, or, as they are commonly called, the *melting Natives*, the true Rutupians, do not come in till the beginning of October, continue in season till the 12th of May, and approach the meridian of their perfection about Christmas. The denizens from France are not to be compared to British *Native* oysters, which are so called because they are born, bred, and fed in this country. These do not come to perfection till they are four years old.

August is a month that hath red-letter days for those who delight in the luxuries of eating. Do we not in that month begin the carnival of “St. Grouse,” and do we not hear in the by-streets of London the pleasant sounds of “Please to remember the grotto?” It is the month that issues in the ever-welcome oyster. In nearly every small street and alley, early in August, may be heard resounding the words, “Only once a year;” and groups of merry

children building their grottos remind us that the long days are passing, that autumn is at hand, and that in a few brief months the Christmas barrel of oysters will be travelling "inland" on the rapid railway, passing in its course the friendly and welcome exchange hamper of country produce, containing the choice pheasant and the plump turkey.

"One story of a grotto, often repeated, may here be told. It was built by the children of a widow, on the Surrey side of the Thames; and, as she was from home on that evening, they brought from her dwelling whatever they thought would render the grotto attractive. The great charm, however, was to be wrought by a small but dingy picture, above and around which they placed their oyster-shells, yet taking care that a good view should be had of it by every passer-by.

"A Jew, it is said—but on this we would not lay stress, for a Christian, so-called, may be greedy of gain, and one of the children of Abraham may be, in generosity, a noble—struck by the sight, offered a shilling for the picture. What a prize was thus presented to the view of these beggars of coppers! It overcame all their ordinary feelings, and, while the children exulted over a shilling quickly to be spent, the cunning buyer chuckled over the profitable purchase he had made.

"With great delight he bore it from one connoisseur to another, only to be assured that his first judgment was right; and then he was anxious to sell it, not merely at a profit of cent. per cent., but at that which is realised when a shilling is changed into hundreds of pounds. Nor was it long before a purchaser at that amount was ready; he only required to be satisfied as to the applicant's right of sale. But here a difficulty arose in the way of avarice;

the man hesitated, then prevaricated, and it was only under the threat of prosecution that he told how the picture was obtained, and agreed that the rightful owner should have the chief part of the sum for which it was to be sold. We leave the joy of the poor widow to be conceived; she was too busy in earning bread for her family to miss the picture; she was not aware that it was gone, until she heard that, placed in the little grotto of oyster-shells as a childish freak, it had thus so singularly obtained for her the means of comfort and improvement she could not have hoped to possess." (*b*)

On the 25th of July, says Brand, the antiquary, being St. James the Apostle's Day, the priests of old were wont to bless apples; and a popular belief too, in 1588, though generally ignored in the more enlightened days in which we live, was, that whoever ate oysters on that day would not be without money for the remainder of the year. This is very probable, for without they were selected with great care, disease and even death might follow. This conjunction of apples and oysters on St. James's Day may have suggested Bianca's remark in the "Taming of the Shrew," when comparing the resemblance of the old Pedant to that of Vincentio, which she remarks was as complete as that of an oyster to an apple.

One must, therefore, take care not to eat oysters during the months of June and July, because they are unwholesome on account of the spawning-time; and also be careful in their selection in August. There are instances when persons, after having eaten oysters during these months, have become ill, and have even died. Last summer (1862), at Ostend, thirty persons were taken ill,

(*b*) "Adventures of an Oyster," pp. 167-8.

in consequence of having eaten oysters in the month of July. They are, during these months, very thin, and without taste; in the month of September they become again fat and eatable, which may be accounted for by the fact of their being self-generated. The strength of the poor oysters is entirely spent in fattening themselves, in order the more to tickle the palate of the epicure in the proper season. (c)

There is not a man, however unobservant, but knows that oysters are a great source of profit to some of that multitude which rises every morning without knowing exactly how, when, and where it shall dine. Billingsgate, in the oyster season, is a sight and a caution. Boats coming in loaded; porters struggling with baskets and sacks; early loungers looking on—it is so pleasant to see other people work; buyers and cheapeners, the fish salesman in his rostrum, the wealthy purchaser who can lay out his hundreds and buy his thousands—all to be met with, together with that noise and bustle, and, far beyond it, all that incredible earnestness which always distinguishes an English market. (d)

Oysters, still sold out of the smacks at Billingsgate, may also be obtained at Hungerford. The real “Miltons” and the “Colchesters” are among the most expensive kind. The costermongers buy oysters of a “good middling quality.” At the commencement of the season the bushel, more or less heaped up, costs 14/-; the general price is 9/- or 10/-; but they have been 16/- or 18/-. In 1848 very large-shelled oysters, the animals being very small, were brought in from the Sussex coast, and had an

(c) “The Oyster,” &c., p. 12.

(d) Ibid.

enormous sale in Thames-street and near the Borough-market. These "scuttlemouths," as they were called, were usually thrown down in a yard, had a few pails of water dashed over them, and were then placed on a barrow, or conveyed to a stall. But some of the better class of dealers laid down their oysters carefully, and gave them oatmeal to fatten on. (e)

The number of oysters sold by the costermongers amounts to 124,000,000 a year. These at four a penny would realise the large sum of £129,650. We may, therefore, safely assume that £125,000 is spent yearly in oysters in the streets of London. (f)

A farm of four acres, if well handled, may give occupation, and even bring pecuniary gain, to the possessor. A garden, for those who thoroughly understand and enjoy it, may secure untold pleasures, and perhaps help to pay the rent of the cottage. But an "oyster-bed" is a pleasure—an *el dorado*—a mine of wealth, in fact, which fills the owners' pockets with gold, and affords to the million untold gastronomical enjoyment and healthy food. On the money part of the question, M. Laviciare, Commissary of the Maritime Inscription, in his 1860 report to M. Coste (on the results of experiments made for the improvement of oyster-beds in the locality of the bay of St. Brieux, on the coast of Brittany,) furnishes the following information: "Between March and May, 1859, about 3,000,000 oysters, taken from different parts of the sea, were distributed in ten longitudinal beds in the above bay. The bottom was previously covered with old oyster shells and boughs of trees arranged like fascines. To these the young oysters

(e) "Adventures of an Oyster," p. 165.

(f) Mayhew's "London Labour and London Poor."

attach themselves, and so fruitful are the results, that one of the fascines was found at the end of six months to have no less than 20,000 young oysters on it. The report further states that 12,000 hectares may be brought into full bearing in three years, at an annual expense not exceeding 10,000 francs. A recent examination has fully and satisfactorily proved the advantageous results obtained on the five banks which have been laid down, and which have exceeded the most sanguine expectations. Three fascines, which were taken up indiscriminately from one of the banks formed in June, 1859, contained about 20,000 oysters each, of from one inch to two inches in diameter. The total expense for forming the above bank was 221 francs; and if the 300 fascines laid down on it be multiplied by 20,000, 6,000,000 oysters will be obtained, which, if sold at 20 francs a thousand, will produce 120,000 francs. If, however, the number of oysters on each fascine were to be reckoned at only 10,000, the sum of 60,000 francs would be received, which, for an expenditure of only 221 francs, would give a larger profit than any other known branch of industry." (g)

But the breeding and fattening of the London oyster has long been a lucrative branch of trade, of which Cockaine may well be proud. It is carried on "contagious" to London, as Mrs. Malaprop would say—principally in Essex and Kent. The rivers Crouch, Blackwater, and Colne, are the chief breeding places in the former, and the channel of the Swale and the Medway in the latter. These are contiguous to Milton, hence Dibdin's song, and hence also the corruption of "melting hoysters"; melting they are too. The corruption is classical, so let it stand.

The demand for native and other oysters by the Londoners alone is something wonderful, and constitutes of itself a large branch of commerce—as the numerous shell-fish shops of the Strand and Haymarket abundantly testify. It is not easy to arrive at correct statistics of what London requires in the way of oysters; but if we set the number down as being nearly 1,000,000,000 per annum, we shall not be very far wrong. (*h*) To provide these, the dredgermen or fisher people at Colchester, and other places on the Essex and Kent coasts, prowl about the sea-shore and pick up all the little oysters they can find—these ranging from the size of a threepenny-piece to a shilling; and persons and companies having layings purchase them to be nursed and fattened for the table, as already described. At other places the spawn itself is collected, by picking it from the pieces of stone, or the old oyster-shells, to which it may have adhered; and it is nourished in pits, as at Burnham, for the purpose of being sold to the Whitstable people, who carefully lay that brood in their grounds. A good idea of the oyster-traffic may be obtained from the fact that, in some years, the Whitstable men have paid £30,000 for brood, in order to keep up the stock of their far-famed oysters.

The centre in England for the distribution of oysters is Billingsgate, the chief piscatorial bourse of the great metropolis, and the countless thousands of bushels of this molluscou dainty which find their way through “Oyster Street” to this Fish Exchange, mark the everlasting demand. Oysters are sold by the bushel, and every measure is made to pay a toll of fourpence, and another

(*h*) At the present time (1890) 50,000 tons of oysters are consumed during the season in London.

sum of a like amount for carriage to the shore. All oysters sold at Billingsgate are liable to this eightpenny tax. The London oysters—and I regret to say it, for there is nothing finer than a genuine oyster—are sophisticated in the cellars of the buyers, by being stuffed with oatmeal till the flavour is all but lost in the fat. The flavour of oysters—like the flavour of all other animals—depends on their feeding. I have eaten of fine oysters taken from a bank that was visited by a rather questionable stream of water; they were very large, fat, and of exquisite flavour, the shell being more than usually well filled with “meat.” What the London oysters gain in fat by artificial feeding they assuredly lose in flavour.

The harbour of Kinsale (a receptacle for much filth) used to be remarkable for the size and flavour of its oysters. The beds occupied the whole harbour, and the oysters there were at one time very plentiful, and far exceeded the Cork oysters in fame (and they have long been famous); but they were so overfished as to be long since used up, much to the loss of the Irish people, who are particularly fond of oysters, and delight in their “Pooldoodies” and “Redbanks” as much as the English and Scotch in their “Natives” and “Pandores.” (i)

Exclusive of oysters bred in Essex and Kent, vast numbers are brought from Jersey, Poole, and other places along the coast, and are fattened in beds. The export of oysters from Jersey alone is very considerable, having amounted on an average of the four years ending with 1832 (j) to 208,032 bushels a year. The Jersey fishing

(i) “The Harvest of the Sea,” pp. 259-60.

(j) In a footnote the author of “The Oyster,” &c., states:—“The exportation has by this time (1863) nearly doubled, but these are the latest statistics we can arrive at.” “In 1876,” says M. S.

then employed, during the season, about 1500 men, 1000 women and children, and 250 boats.

Think of this, ye oyster-eaters! Think that ye are doing—such is the wise ordination of an overruling Providence—some good when you are swallowing your antepandial oyster, and are giving employment to some portion of those 3000 people who work for you at Jersey, besides helping to feed the cold-fingered fishmonger, who, with blue apron and skilful knife, tempts you to “Hanother dazzen, sir?”

Fancy if you can, also, that curiously courteous exchange which goes on every Christmas between our oyster-eating country cousins and our turkey and goose-loving Londoners. To the man

“Who hath been long in city pent
'Tis very sweet to gaze upon the fair
And open brow of heaven:—to breathe a prayer
Full in the face of the blue firmament”—

sings John Keats. Oh, if he had been but an oyster-eater, that article from the “Quarterly,” savage and slaughterly, would not have killed him; but it is also very sweet to gaze upon a turkey, a leash of birds, a brace of pheasants, and, as Mrs. Tibbetts hath it, “a real country hare.” Such a present is promptly repaid by a fine cod packed in ice, and two barrels of oysters. How sweet are these when eaten at a country house, and opened by yourselves, the

Lovell, author of “Edible British Mollusca,” “Jersey oysters were very scarce, and the beds in a bad condition.” And, in his Report for 1881 (p. 50), Lieutenant Winslow, as it in corroboration of the latter, states that “The oyster fisheries of Jersey afforded employment to 400 vessels. In six or seven years the dredging became so extensive, and the beds so exhausted, that only three or four vessels could find employment, and the crews of even that small number had to do additional work on shore, in order to support themselves.”

barrel being paraded on the table with its top knocked out, and with the whitest of napkins round it, as we shall presently have occasion to show. How sweet it is, too, to open some of the dear natives for your pretty cousin, and to see her open her sweet little mouth about as wide as Lesbia's sparrow did for his lump of—not sugar, it was not then invented—but lump of honey! How sweet it is, after the young lady has swallowed her half-dozen, to help yourself! The oyster never tastes sweeter than when thus operated on by yourself, so that you do not “job” the knife into your hand! True labour has a dignity about it.

So important is our illustrious bivalve as an article of trade, that it is protected by law. It is said that the only two things that George the Fourth ever did—the great Georgius, whom Mr. Thackeray envies and satirises—were to invent a shoe-buckle and an exquisite hair-dye. The brains of the black Brunswicker could do no more. But there is one act also—an Act of Parliament—which was passed in his reign, for which he is to be thanked. The man who was at once the Lucullus and Apicius of his times must have had some hand in the framing of that Act.



CHAPTER XIII.

THE OYSTER AT HOME.

MILTON, QUEENSBOROUGH, ROCHESTER, AND FAVERSHAM OYSTERS
—COLCHESTER AND ESSEX BEDS—EDINBURGH PANDORES AND
ABERDOURS—DUBLIN CARLINGFORDS AND POWLDODDIES—
CORNISH OYSTERS AND THE HELFORD BEDS—POOR TYACKE
AND HOW HE WAS DONE—DREDGERS AND THEIR BOATS—
AULD REEKIE'S CIVIC CEREMONIALS—SONG OF THE OYSTER—
ITS VOYAGE TO MARKET AND JOURNEY BY RAIL—USEFUL
INSTRUCTIONS CONCERNING THE OYSTER.

When the Romans taught the Britons the construction of oyster-beds, they made a return in kind for some of the luxuries they had derived from our shores. Oyster-beds have long been, and are still, discoverable in various parts of Great Britain.

The trade in oysters, as we have seen, has been an object of consideration in England for many ages, and now ranks in importance with the herring, pilchard, and other fisheries. The excellence of our oysters made the formation of artificial beds an object of attention soon after the Roman conquest; and the Kentish and Essex beds show a pedigree in consequence much older than that of the noble descendant of any Norman adventurer who came over with the Conqueror, claiming, on this

head alone, precedence for our "Natives" amongst all the oysters of the known world. But Britain is the boasted land of liberty, and the "Natives" of one part of her coast boldly assert their equality with the "Natives" of any other. If London delights in Milton, Colchester, or Whitstable oysters, Edinburgh has her "whispered Pandores" and Aberdours, and Dublin her Carlingfords and "Powldoodies of Burran;" whilst all round our shores each locality boasts of its own "Natives" as the best oysters in the land.

Lest it should slip my memory, let me say a few words in praise of the Carlingford oyster. Of all molluscs it is the best in Ireland; a black-bearded fellow, delicate and of fine flavour, to be eaten in Dublin alternately with the Redbank oyster, at a magnificent establishment in Sackville Street, and to be washed down with alternate draughts of brown stout. It is said "to want nothing that it should have, and to have nothing it should want." It is round and rough as a walnut; opens white, fat, and juicy; it is neither too large nor too small, and blends with extreme delicacy the racy sharpness of the sea with the milder flavour of the fish. But there can be no dispute concerning tastes, and the Malahide, the Burren, and the Lissadell have all their respective admirers. The Hibernian will tell you that even our Natives are inferior to these. He is right in his patriotism, but wrong in his assertion. How often do our prejudices trip up our judgment. (a)

Arklow was once famous as the nursery of Irish oysters. From thence, as well as from Wexford, the artificial oyster-beds were abundantly supplied with stock, which, being furnished by the fishermen at so much a bushel, and laid

upon the beds for two or three years, became well-conditioned and full-flavoured ; but the "Report of the Irish Fishery Commissioners," in 1874, gave a most unsatisfactory account of many of these fisheries ; and it is said that the Carlingford beds, once so productive, are nearly dredged out, and in 1876 the take did not exceed a few thousands. The Wexford and Tralee beds were in the same condition from over dredging and a succession of bad spatting years. It is not lawful to sell oysters in Ireland in the months of May, June, and July. The Wexford men dredged for them, of course, in the other months, but one reason of the beds being badly stocked was, that in the closed months they were regularly dredged by Beaumaris boats, which replenished their own exhausted beds with them ; and in 1863 a French lugger visited Wexford seven times, carrying off on each occasion a large quantity of oysters for "laying down" on the French coast. (b)

The amount of oysters taken on the principal natural oyster-beds in 1876, off Arklow, was 7520 barrels of 450 each, large and small, at prices from 18/- to 24/6 per barrel. In 1875, 13,640 barrels were taken. The Burran Bank oysters are highly esteemed in Dublin, and are called "Burton Bindons." They are brought from Kilkerran and Rossmuck Bays, in Galway, and are laid down to fatten on the Red Bank oyster-bed in Aughinish Bay. Formerly Mr. Burton Bindon was the possessor of these beds, but now Mr. Singleton has succeeded him.

There are oyster-beds in the Shannon, said in 1836 to yield a revenue of £1400 ; and formerly, there was a small bed in Cork harbour, of no great extent, but the oysters were

(b) "Morning Post," August 29th, 1864.

larger, and prized for stewing ; the latter no longer exists. In Lough Swilly there are oyster-beds, but the oysters were getting very scarce in 1876, and it was proposed having what is called in Ireland a jubilee, viz., closing the banks, or a portion of them, for two years, and preventing the picking or taking of small oysters. (c) Oysters are increasing in scarcity and dearness in Ireland and in England, and this may be traced in a measure to the increased demand, the railroads conveying the oysters into the country ; and Mr. Farrer stated, in the evidence before the Committee on Oyster Fisheries, in 1876, that oyster cultivators had great difficulty in obtaining oysters to fatten, because they were taken into the manufacturing districts, where the people eat them though in bad condition ; whereas they formerly had them brought to the beds in the Thames.

It is said that over-dredging has destroyed many of the oyster-beds, and doubtless this has been the case in places ; but on some parts of the coast it is absolutely necessary to dredge during the summer, which is the close time, to keep the beds free from sand, weeds, and mud, which accumulate so much that the spat is injured ; but the principal cause of the scarcity of the oysters may be attributed to the low temperature of the water during the spatting season ; the last few summers having been cold, and the weather changeable.

Between London and Glamorganshire there is a large trade in pickled oysters, and we are told that seventy-two million oysters are annually consumed in London alone. (d)

The oyster-fishery of most consequence in Scotland is that of the Frith of Forth. The oyster-beds extend there

(c) "Report on Oyster Fisheries," 1876 ; Mr. Blake's evidence.

(d) "Journal of Society of Arts," August 24th, 1883.

about twenty miles, from the island of Mecera to Cockenzie. The best are procured near Burntisland, on a bed belonging to the Earl of Morton, on the rocky ground opposite Porto Bello, and at Preston Pans. Not many years since capital oysters might sometimes be bought in Edinburgh at a shilling a hundred.

The Cockenzie fishermen derive a good portion of their annual income from the oyster trade, and dredge for them at high and low tide. The crews of the boats keep up a wild and monotonous song (in which they believe there is much virtue) all the time they are dredging, and assert that it charms the oysters into the dredge. (e) The same authority further states that, as a class, the fishers of the Scottish coast are very superstitious. They do not like being numbered whilst standing or walking. It offends them very much to ask them, whilst on their way to their boats, where they are going to-day. They consider it unlucky to see the impression of a very flat foot upon the sand, and they will not go to work if, in the morning, on leaving their houses, a pig should cross their path. An experimental steam fishing-vessel has been built at Cockenzie; she is a dandy cutter-rigged craft, forty tons burden, assisted with auxiliary screw steam power, for the purpose of dredging oysters during the winter months, and deep-sea trawling during the summer.

The celebrated "Pandore" oysters are principally obtained from the neighbourhood of Preston Pans. The exclusive right to fish, dredge, and cultivate oysters and mussels, belongs to the barony of Prestongrange, extending as far as the shores of the barony and to the centre of

(e) "The Fisher Folk of the Scottish East Coast," *Macmillan's Magazine*, October, 1862, No. 36.

the Forth. During the last century, and the earlier portion of this, the proprietors of the barony were able to maintain control over the fishermen, and to regulate the fishing. . . . At that date a number of salt works existed along the shore, and the oysters taken near them were termed "Pandores," which in Edinburgh still designates the finest oysters. (*f*) According to Frank Buckland, the oysters on the west coast of Scotland have a very beautiful shell, quite different from those on the east coast of England, and the beard of the oyster is always black, and this is also the case with the Irish, American, and Lisbon oysters.

Some of our principal beds are those of Whitstable, Rochester, Colchester, Milton, Faversham, Queenborough, and Burnham. Colchester has been celebrated for its oysters from a remote period, and they were deemed an appropriate present from the authorities of the town to ministers of state and other eminent persons. We hear of their having been sent, in the reign of Queen Elizabeth, to Leicester and Walsingham. (*g*) At the Annual Colchester Oyster Feast, held in the Town-hall, October, 1862, Mr. Miller, M.P., mentioned that Mr. Goody, clerk to the Colne Fishery Company, with himself and a few other gentlemen, had appealed to the Treasury, because it was apprehended that Belgium, to which a large number of oysters are sent, was about to impose a duty which would inflict a serious injury upon the town. However, it was found from the interview that there was no immediate prospect of the anticipated danger, and a treaty was con-

(*f*) "Report on Oyster Fisheries," 1876. Letter in Appendix, by Edward Vale, factor for Sir G. G. Suttie.

(*g*) Cromwell's "History of Colchester," vol. 2.

cluded with Belgium, in which a special reservation had been made in regard to oysters. (h)

In an interesting letter from Mr. George C. Wittey, Secretary of the Colchester Native Oyster Fishery Company, Limited, I am informed that "since the time of Richard I., who granted the same (oystery fishery) to this Corporation by Royal Charter, *all the fish*, whether floating in the river, or *shell fish* found in it *from the town to the sea*, situate about seven miles distance is their property; but is now held under lease from the Corporation by the 'Colne Fishery Company,' who chiefly supply the London market with oysters. The best being those of native growth, but the bed of our river Colne and the creeks running in from the sea seem so favourable to the development of the oyster generally, that the brood is purchased from various places, and placed on broken shells along the banks and creeks of the shallow sea-water, until they become fit for sale, often under the name (in London) of 'Colchester Natives.' The maturing of oysters is divided into a period of four years, during which the names they are known by are, in the first year, '*brood*,' second year '*half ware*,' third year '*ware*,' and fourth year oysters full grown and ready for sale. Second to the Colne Fishery Company is the Tollesbury and Mersea Company, possessing numerous oyster beds in that locality. Lastly, I may mention our own company as next in rank, who possess about three miles of beds in various reaches of the creeks of the river, and whose productions, I may say, are second to none, as testified by the best judges."

As the information concerning Whitstable and its celebrated oyster trade is too lengthy, and also of too much

importance, to dismiss in a paragraph or two, I shall make it the subject of a separate chapter, and proceed with the list of our principal produce.

The "Milton natives" bear the bell, or may be said to be the pearls among British oysters. King John granted these fisheries to the Abbot of Faversham, in whose hands they remained till the dissolution, and they have been dredged from the earliest times by a company of fishermen, ruled, like those of Faversham, by certain ancient customs and bye-laws. (*i*)

Jersey oysters are brought over and bedded in the Southampton water. They are described as being small, but of superior flavour, and are conveyed long distances to be laid down, naturalized, and afterwards sold as natives. They are also remarkable for their saline flavour when first brought over, but it goes off after they have been bedded some time at Southampton. (*j*) In 1876 Jersey oysters were very scarce, and the beds in a bad condition. It is said that formerly there were fine oyster-beds between Portsmouth, Hayling, and the Isle of Wight; and recently a breeding place on the French system has been established at Hayling Island, and there is considerable trade carried on in oysters. (*k*) •

There are extensive oyster-beds in the Medina and Newport rivers, in the Isle of Wight, and a large quantity were bred in 1880, and were in good condition up to 1881. (*l*) The Manor of Osborne is said to derive its old name of Austerbourne, or Oysterbourne, from the oyster-beds of

(*i*) Murray's "Handbook, Kent and Sussex."

(*j*) "Field." Note by the Editor.

(*k*) "Edible British Mollusca," p. 131.

(*l*) "Oyster Culture and Oyster Fisheries," by Professor Hubrecht.

the Medina. (*m*) A bed of oysters was discovered off Eastbourne, some years since, the fish being of a very superior and delicate flavour. The price was 1/- per hundred, but it rose to 2/-; and another large bed, which was valued at £5000, was found about three miles off the mouth of Dartmouth harbour, about the same time.

“I cannot be expected to take the reader on a voyage of discovery all round the coast, nor to the Channel Islands, to taste the oysters which Providence has spread out for our enjoyment with such a lavish hand. But there is one little spot on the shores of Cornwall which I cannot pass over, because from it came one of the colonies on the banks of the Thames, from which the Whitstable boats still draw their annual supply. Into Mount’s Bay the Helford river, upon which stands the little town of Helston, empties itself, opposite Mount St. Michael’s, into the sea, and in the estuary of that little river a person of the name of Tyacke, within the memory of the ‘oldest inhabitant,’ rented certain oyster-beds, famous amongst Cornish gourmets for a breed of oysters, which, it is said, the Phœnicians, ‘a long time ago,’ had discovered to be infinitely preferable to the watery things they got at home. These Helford oysters are regularly brought to London; but when Tyacke rented the beds they were unknown to the good citizens who frequented the oyster taverns, of which the Cock in Fleet Street is but a last lingering type. Determined to make his venture, Tyacke loaded a fishing smack with the best produce of his beds, and coasted along the southern shores till, passing round the Isle of Thanet, he found himself in the mouth of the Thames. Little did the elated oyster dredger think that that mouth would (*m*) “A Guide to the Isle of Wight,” by the Rev. Edward Venables, M.A.

swallow up the whole of his cargo, but so it came to pass. It had long been evident to those on board that oysters that travel, no less than men, must have rations allowed on the voyage, if they are to do credit to the land of their birth. Now the voyage had been long and tedious, and the oysters had not been fed, so Tyacke got into his boat, and obtained an interview with the owner of the spot at which it touched land. He asked permission to lay down his oysters, and feed them. This was granted, and after a few days the spores of *ulva latissima* and *enteromorpha*, and of the host of delicate fibrous plants which there abound, and all of which are the oyster's great delight, made the whole green and fat, and in the finest condition for reshipment. Four days, it is said, will suffice to make a lean oyster, on such a diet, both green and plump; and Tyacke, joyful at the improvement which he daily witnessed, let his stock feed on for a week. It was towards evening that he bethought himself, as the tide was out, that if he meant to reach Billingsgate by the next morning, it would be wise to reship his oysters before turning in for the night. The boat was lowered, but, as he attempted to land, he was warned off by the owner of the soil, who stood there with several fierce-looking fellows, armed with cutlasses and fowling-pieces, evidently anticipating the Cornishman's intention, and determined to frustrate it at all hazards.

'What do you want here?' he asked of Tyacke.

'The oysters I put down to feed,' was the reply. 'They were placed there by your permission, and now I am anxious to reship them, to be in time for to-morrow's market.'

'True,' replied the Kentishman, 'I gave you leave to lay down the oysters and feed them, but not a word was said about reshipping them. Where they are, there they

stay; and if you persist in trespassing, I shall know what to do.'

"Poor Tyacke found himself much in the predicament of many a flat who has been picked up by a sharp. A century ago law was not justice, nor justice law. Perhaps it may not even be so now; and the story of the lawyer who ate the oyster in dispute, and gave each of the disputants a shell, may hold as good in our day as it did in that when the author of the 'Beggars' Opera' put it into verse." (n)

The demand for oysters, wherever it exists along our coasts, creates a profitable source of employment to a class of men who necessarily become experienced seamen; and dredging for oysters is carried on in fleets, as the beds mostly lie within a comparatively small space. "A fleet of oyster-boats at work in one of our bays or estuaries, when there is a freshening breeze, is a sight of no little interest, especially if the sun is going down into its home of mist, yet dyeing with its richest colours, amber, yellow, and crimson, the cirrus and stratus clouds through which he has sailed so joyously the whole day, while the waves, instinct with life, are tossing from one to another the liquid gold with which the setting luminary so bounteously arrays them. The sails may be seen flapping to and fro, and then the boat glides slowly by, with the sun edging the sails, the spars, and the red vane of the mast-head. Everything at such a time assumes the richest colours. The vessels—the scene of the dredger's labours—ever in motion, tack to and fro over the oyster-beds, their sails now glowing in the sun-light, and then their bows dashing through the crests of the waves, which in return cast over

them a shower of spray, which seems ever and anon like a golden shower. Even the old, brave, weather-beaten hulls, which on the beach appear so sombre, when wet with the spray, and dashing back the sun-light, add much to the splendour and gaiety of the scene." (*o*)

The times for going out to dredge are at high tide and low tide. The boats used are the smaller sized ones employed in the white fishery. The dredge somewhat resembles in shape a common clasp-purse; it is formed of net-work, attached to a strong iron frame, which serves to keep the mouth of the instrument open, and acts also as a sinker, giving it a proper pressure as it travels along the oyster beds. When the boat arrives over the oyster-scalps, the dredge is let down by a rope attached to the upper ring, and is worked by one man, except in cases where the boat has to be sailed swiftly, when two are employed. Of course, in the absence of wind, recourse is had to the oars. The tension upon the rope is the signal for hauling the dredge on board, when the entire contents are emptied into the boat, and the dredge returned to the water. These contents, not including the oysters, are of a most heterogeneous kind—stones, sea-weed, star-fish, (*p*) young lobsters, crabs, actiniæ—all of which are usually returned

(*o*) "Adventures of an Oyster," p. 152.

(*p*) "That there should exist in several places local enactments requiring fishers to tear in pieces all the sea-stars they take up, instead of throwing them alive into the water, will appear necessary when we consider the immense number (of oysters) they consume. On casting a dredge thousands are brought up at a haul, 'as if,' it has been said, 'the bottom were formed of a living bank of them, or a submarine hive had been disturbed in the process of swarming.' Each individual, too, produces, in every season, thousands of eggs; and hence sea-stars are considered valuable as manure in France."—"Adventures of an Oyster," p. 154.

to the water, some of them being considered as the most fattening ground-bait for the cod-fish. The whelks, clams, mussels, cockles, and occasionally the crabs, are used by the fishermen as bait for their white-fish lines. Once, in a conversation with a veteran dredger as to what strange things *might* come in the dredge, he replied, "Well, master, I don't know what sort of curiosities we sometimes get; but I have seen gentlemen like yourself go out with us a dredgin', and take away big baskets full o' things as was neither good for eating or looking at. The Lord knows what they did wi' 'em." During the whole time that this dredging is being carried on, the crew keep up a wild monotonous song, or rather chant, in which they believe much virtue to lie. They assert that it charms the oysters into the dredge.

"The herring loves the merry moonlight,
The mackerel loves the wind;
But the oyster loves the dredger's song,
For he comes of a gentle kind."

Talking is strictly forbidden, so that all the required conversation is carried on after the manner of the *recitative* of an opera or oratorio. The oyster-scalps are gone over by the men much in the way that a field is ploughed by an agricultural labourer, the boat going and returning until sufficient oysters are secured, or a shift is made to another bed. (q)

The dredging for oysters is carried on in fleets, as the beds mostly lie within a comparatively small space. The boats, which are about fifteen feet long, usually carry a man and a boy, or two men. The dredge is about 18 pounds weight, and is required to be heavier on a hard

than a soft bottom, and each boat is usually provided with two dredges.

In former days the commencement of the dredging season was held sufficiently important to entitle it to a civic ceremonial, at least such was the wont of the municipal authorities of "Auld Reekie," who also paid a particular regard both as to the supply and the price of the "breedy creatures" furnished to the good citizens of Edinburgh. The "Feast of Shells" was ushered in by the municipality of the ancient city, making, for provosts and bailiffs, a somewhat perilous voyage to the oyster-beds in the Frith of Forth; and though the solemnity of wedding the Frith formed no part of the chief magistrate's office, as wedding the Adriatic with a gold ring did that of the Doge of Venice, the welkin was made to ring, as three cheers from all present uprose and announced the lifting of the first dredge upon the deck of the civic barge.

Raised out of his native waters, the oyster makes the voyage to the first station in his destined travels, in the company of those to whom long and kindred ties have bound him, on board the smack upon the deck of which they were jointly landed from the deep; and during the whole voyage, if it prove a long one, he is attentively supplied with refreshing water, so that when the smack lies alongside the wharf at which he is to part company with his captors, he is still as lively as when they first took him as a passenger on board.

Arrived in port, the oyster first truly becomes sensible of the miseries of slavery. Shovelled into sacks, or cast anyhow into carts and handbarrows, he may consider himself fortunate if a kindly hand but extends to him, in his great necessity, a drink of water impregnated with salt, instead of his own delicious beverage from the sea. Yet

this is a cruelty which should be avoided wherever sea-water can be obtained, because it is neither the salt nor the water which sustains the oyster's life, but the spores of vegetation which abound in the sea, and by mixing salt with fresh water we destroy even the life of the incipient fresh-water plants which the latter contains. It is as great a mockery as when Grumio proposes to give the famished Katherine the mustard without the brawn, and need no longer exist if oyster dealers, who cannot obtain sea-water, would provide themselves with the prepared salts for the instantaneous production of artificial sea-water, the recipe for the preparation of which is as follows:—

“For ten gallons it requires sulphate of magnesia, $7\frac{1}{2}$ ounces; sulphate of lime, $2\frac{3}{4}$ ounces; chloride of sodium, $43\frac{1}{4}$ ounces; chloride of magnesia, 6 ounces; chloride of potassium, $1\frac{1}{4}$ ounce; bromide of magnesium, 21 grains; carbonate of lime, 21 grains.”

This should be allowed to stand exposed to the air in a strong sunlight for a fortnight before it is used, during which time a few growing plants of *enteromorpha*, or *ulva*, should be introduced to throw off spores. These plants cost about one shilling each in London. The water then, when under the microscope, will be found to contain a confervoid vegetable growth, which forms as nourishing a food for the oyster as the spores of sea-weed in its ocean bed. Oysters laid down in a large trough, and covered with water, will continue to live and thrive for months; and it was to some such method as this that the Romans were indebted for the preservation of their oysters in inland stews. On no account should oatmeal, flour, or any such *dead* stuff, be added, which only serves to make the water foul and the oyster sick.

When oysters are to travel by rail, they are usually dispatched in barrels. Where the barrels are packed at the beds, as the Colchester or "Byfleet barrelled oysters" are, they should not be disturbed till wanted for the table, as they will keep good as they are for a week or ten days; for, being carefully packed so as not to spill the water each carries in a reservoir of Nature's providing, they need no other *viaticum* for the journey.

The moment an oyster in the barrel opens its mouth it dies, because there is nothing in the barrel to sustain its life. It is therefore as well, on the receipt of the little cask, to open it at once by removing the top and the first hoop, and then to place the top on the uppermost layer of oysters, keeping it in position by the addition of some heavy weight, which causes the staves to spread and stand erect; and as the layers of oysters are required for the table, it is only necessary each time to replace the top and the weight to a similar position, to keep the remainder fresh for a few days. But the true lover of an oyster will have some regard for his little favourite. Sea-water may be had in London and other large towns for sixpence per gallon, and when that cannot be procured the pound-packet of salts, according to the recipe we have given, will not cost more than eighteen-pence at any chemist's, and that quantity will produce three gallons of artificial sea-water. Thus provided, unpack the barrel, and spread out the oysters in a large flat earthenware dish, just covering them with water, and you may keep them for many weeks as fresh as when they first left their beds. (r)

(r) "The Oyster," pp. 50-3.

CHAPTER XIV.

THE OYSTER ABROAD.

BRITISH OYSTERS IN OSTEND QUARTERS—HOLSTEIN, SCHLESWIG,
AND HELIGOLAND NATIVES—NORWEGIAN AND BREMER OYSTERS
—AMERICAN OYSTERS—FRENCH OYSTERS—DUTCH OYSTERS—
MEDITERRANEAN OYSTERS AND CLASSICAL JUDGES—CHINESE
OYSTERS—OYSTER CULTURE IN CHINA.

I SHALL begin my list of foreign oysters with the best of them all, the next of kin to our Native, and next to it the best oyster in the world.

1. *The Ostend Oyster* is nothing more than the real British oyster, cleaned and fattened in the Ostend oyster-beds. It has a fine, thin, transparent but deep shell, the upper shell being quite flat; it is very full, white, and fat, has a very small beard, and is very digestible. During a south-west wind, which brings to these beds the microscopic spores of sea vegetation and animalcules upon which it delights to feed, from the channel, its beard is of a green colour. The Ostend oyster is much prized in Berlin, which it reaches the quickest of any from the sea (in thirty-six to forty hours), and consequently lives there several days, remains the longest fresh, and can be sent farthest. In the winter of 1862. Ostend oysters were sent to Moscow and Odessa, where they arrived still good and tasty. The

former were seventeen days, and the latter eleven days on their way. Scarcely any other kind of oysters could be sent to such a distance. In the autumn of 1847, after the opening of the Cologne-Minden Railway, the first trial was made of sending these oysters to Berlin, *viâ* Cologne. The result was most satisfactory: they sold for $1\frac{1}{2}$ thalers ($\frac{5}{3}$) the hundred. This caused no little sensation, especially among the old oyster dealers, who were accustomed to receive from five to six, even from eight to nine thalers per hundred. The good folks of Berlin are now supplied with abundant fresh and fine oysters. The Ostend natives may be obtained from the owner of the oyster-beds in Ostend. I speak of Berlin, as the Germans are great oyster-eaters, and the North, in a great measure, is supplied from thence.

In Brussels, Antwerp, Ghent, Bruges, and Lille, Ostend oysters are eaten with slices of home-baked bread and butter. They are served up in their shells, open, and not broken apart. They have a tender, fragrant, and melting flesh, and are only half the size of ordinary oysters; but they gain in thickness what they lose in size. In Flanders and the Netherlands they are known under the name of "English Oysters," but are called in Paris after the name of the beds where they are reared. They are in reality Edinburgh "Natives," cleaned and fattened in the Ostend oyster-beds, and hence called Belgian or Ostend oysters.

The oyster of Ostend cannot be too much recommended to gourmets. It is to the common oyster what a chicken is to an old hen. It is a draught of bitter ale to a thirsty palate. It is a known fact, that after having abstained from food for a long time, the first oyster one eats produces a kind of unusual rictus (or opening of the

mouth), the reason of which physiologists have never been able to explain. This same sensation is produced in eating an Ostend oyster, but it is much sweeter, more lasting, and much more delightful. If the Romans had ever known them, they would have sung their praises both in verse and prose, and would by far have preferred them to their sadly over-praised oysters from the Lucrine sea.

The only oyster which can be brought into competition with those of Ostend, in the same markets, are the Whitstable oysters, which have only recently become an article of trade on the Continent. (a) There are also "natives" from the Channel, generally larger than the former, but unequal, not being sorted, very fat and full, but much more tender, and do not keep fresh so long. The cause of this may be that they are first taken from Whitstable to London, where they are packed up and sent by sea and rail to Hamburgh and Berlin, which takes always from six to seven days. They have a fine flavour, and are by some people preferred to the Ostend oysters: although the latter, generally speaking, occupy the first rank. These two species, and that of Holstein, are the best oysters to be met with in the north of Europe.

2. *Channel Oysters*.—The oysters which, more particularly in the North of Germany, are an article of trade, come from the Bay of St. Brioux and the Rock of Cancale, on the British Channel, between the castle of that name, Mount St. Michael, and St. Malo, and from the Channel between Calais and its extreme point near Falmouth. The bottom of this sea is flat and firm, and its stream near the bottom not very strong, both favourable circumstances for the propagation of oysters. This propagation must be

(a) About 1860.

very considerable, and the banks where the oysters breed very extensive, since, in spite of the continual dredging, they produce a sufficient quantity without any apparent decrease, to guard against which the beds of St. Brieux are carefully supplied. The dredging lasts generally from the middle of September till the end of May; during the other months the fishing should properly be discontinued, because the spawning, which then takes place, would be disturbed, and because during that time the oyster is generally not fit for food.

3. *Holstein Oysters* are very good and fine, but the sea-banks do not afford enough for the present consumption, so that it is necessary to have good connexions in order to obtain real and good Holstein oysters. They are easily distinguished from all the other oysters by their size, the thin, greenish-blue shells, especially the lower shell. The upper shell is always concave, by which they are the more easily distinguished from the Heligolandiers, which have always a strong convex upper shell. As to the little animal itself, it is very fat, white, thick, and tender, and therefore very digestible. It has only a small beard, by which it is distinguished from the Norwegian and Scottish oyster, which, by the appearance of the shell, might be mistaken for the Holstein oyster by novices in gastronomy. These delicate favourites are to be obtained from the lessees of the Royal Oyster-banks on the western coast of Holstein in Flensburg, in the kingdom of Denmark.

4. *The Schleswig Oyster of Husum and Silt* is very like the former—almost indistinguishable. It is very excellent, but seldom exported, and consumed for the most part in Kiel. The two last-named oysters are often taken to St. Petersburg by sailors, when making the passage to and fro.

5. *The Heligolanders* are very large ; have thick shells, which renders the duty and carriage very high, but are not at all fine, and generally sold in all the innocence of ignorance by dealers as Holstein oysters.

Have nothing to do with *Norwegian oysters* ; I only mention them here as things to be shunned. *Bremer oysters*, the *Neuwerkers*, and the *Wangerogers*, however, deserve a better fate.

6. *The Oyster of the Bay of Biscay* is of the same size as that of Holstein, with a very large beard, like some caught in the south of England. The beard, like the oyster itself, is quite grass green—a quality which is to be found generally only with oysters from Dieppe, Cancale, and the Marennes. Its flavour is very fine and good, but great care must be taken, in opening the shell and detaching the oyster, not to break the double shell, which they mostly possess, for this contains sulphuretted hydrogen, which gives a bad smell and flavour to the oyster, and poisons the stomach of the consumer.

7. *Dutch Oysters* are both good and dear. The four sorts I recommend are Seelanders, Vliessingers, Middleburgers, and Vieringers. The latter are almost the finest and best, but uncommonly dear, and are mostly consumed in Holland.

8. *French Oysters*.—The French oysters are chiefly taken from beds in the Bays of Cancale and St. Brieux, from Marennes, from Havre and Dieppe, from Dunkirk, and from the Bay of Biscay. The three first are very fine, but the distance to Paris is too great ; they are therefore dear in that capital. Those from Dunkirk are similar to those of Ostend, but not quite so fine ; and those from the Bay of Biscay are quite green, and highly esteemed in the south of France, especially at Bordeaux.

9. *American Oysters*, though, to my taste, by no means so delicate as others I have mentioned, are nevertheless superior for cooking. For my own part, although I have stated that pepper, vinegar, lemon juice, and other stimulating ingredients, are commonly made use of when eating the oyster, I offer, in all courtesy, the decided opinion, that the taste must be vitiated that can swallow such in preference to the delicate, fresh, luscious, charming little morsel, saturated merely, or perhaps the word ought to be merely bedewed, like the rose on a summer morning, by its own liquid life's blood. Americans themselves generally prefer their large oysters even to our British Natives.

10. *Mediterranean Oysters*.—I have already referred to classical authorities for the character the ancients gave those of Circe and the Lucrine Sea ; and the old rule, “*de mortuis nil*,” forbids me to say in what rank I place Horace the inimitable, Seneca the wise, and Pliny the naturalist, as judges of what an oyster should be. Where ignorance is bliss, people can be very happy. Till the Chinese, by an accidental fire, had become acquainted with the taste of roast pork, there were many less fires in China than now. Till the Romans found the Rutupians, the Lucrine flourished ; so did Circe.

Thus far I have dwelt upon the qualities of the Continental Oyster, but now, in concluding this chapter, I must introduce to the reader's notice the cultivation of the oyster in the Celestial Empire.

M. Dabry de Thersant, in a number of the “*China Review*,” as quoted in the “*Flight of the Lapwing*,” states that artificial oyster-beds were formed in China long before they are known to have existed amongst the Romans, and while in Europe essays and pamphlets are being written on

the theory of the subject, the practical Chinese have been obtaining good results for the last 1800 years, notwithstanding the fact that they have no clear ideas as to the nature of the oyster or its means of reproduction. The principal oyster-beds are situated near the mainland, opposite the north and east of Namoa Island. Pieces of rock or stones are laid out on the beds, old oysters are placed on them, and here the spat is deposited. After three years, the oysters are brought to market. As regards quality, they are inferior to those of Amoy and Foochow, which are exported on a large scale to the ports along the coasts. (b)

M. Dabry de Thersant says that there are some prolific beds in the neighbourhood of Macao, which, after deducting the working expenses, about £600, return an annual profit of more than £2000. A staff of eight men are employed on these beds, at about £1 per month each. Another bed, which is leased for an annual sum of £10, for thirty years, returns a profit of from £1100 to £1200 per annum. (c)

The best oysters are those collected in January, February, and March. There are several species of oysters in China. The *Bamboo Oysters* are grown in the following manner:—Old oyster-shells of two kinds are selected, thick and thin, each of the thick ones having a hole one and a half inches in diameter bored through the centre of it. Slips of bamboo about two feet in length, one and a half inches wide, and half an inch thick, are pointed and split to about half the distance down, a thin shell is inserted in each split near its bottom end, the two top

(b) "China: Imperial Maritime Customs. Special Catalogue, International Fisheries Exhibition, London, 1883."

(c) "Flight of the Lapwing."

ends of each split are pressed together and thrust into the perforated shell, which holds it securely.

When a sufficient number of bamboos have been prepared, they are planted very closely together on the mud flats, much in the same way as a gardener plants cuttings. At the end of about a month, the spat, which had attached itself to them when planted out, has developed into small oysters. The bamboos are then taken up and transplanted about six inches apart. In four or five months the bamboos are almost hid by the oysters which cluster round them, and which are now collected and sold. (*d*)

The shells of the oyster and murex were used by the Romans as tooth-powder, and oyster shells are now used as manure. The Chinese use the shells, when ground down, in certain skin diseases; and the valves of *Ostrea taliensis*, and of other species of oysters, are calcined until quite white, pulverized, and then mixed with the juice of certain plants, as a dressing for ulcers. (*e*)

Fresh oysters are used to cure freckles.

In the crab traps in China, which are made of bamboo in the shape of a truncated cone, the bait is placed in the middle of the basket, and an oyster is generally used for that purpose.

The Chinese have three differently sounding words to denote a large, a small, and a round oyster.

(*d*) China: "Imperial Maritime Customs, III. Miscellaneous Series, No. 11." "Special Catalogue of the Chinese Collection of Exhibits for the International Fisheries Exhibition, London, 1883."

(*e*) "Essai sur la Pharmacie et la Matière Médicale des Chinois," par J. O. Debeaux.

CHAPTER XV.

HOW TO COOK AND EAT OYSTERS.

HOW AND WHEN TO EAT AN OYSTER—NAMES OF WINES BEST SUITED TO ENHANCE THE TASTE OF THE OYSTER—SPIRITS SUITABLE AND AVOIDABLE FOR SAME PURPOSE—AN ODD WAY OF COOKING AN OYSTER—CHINESE MODE OF COOKING OYSTERS—THE ANCIENTS AND THEIR WAYS OF PROCEDURE—OYSTER SOUP—POTAGE A LA POISSONNIERE—OYSTER MOUTH SOUP—WHITE OYSTER SAUCE—BROWN OYSTER SAUCE—OYSTER ATLETS—CURRIED OYSTERS—TO STEW OYSTERS—AMERICAN BOX STEW—DUTCH OYSTERS—TO FRY OYSTERS—GRILLED OYSTERS—OYSTERS ROASTED—OYSTER SAUSAGES, &c., &c.

“And the recipes and different modes of dressing
I am prepared to teach the world for nothing,
If men are only wise enough to learn.”

Athenæus, *Deipnos*, Book 3, c. 69.

“Let us royster with the oyster—in the shorter days and moister,
That are brought by brown September, with its roguish final R;
For breakfast or for supper, on the under shell or upper,
Of dishes he’s the daisy, and of shell-fish he’s the star.
We try him as they fry him, and even as they pie him;
We’re partial to him luscious in a roast;
We boil and broil him, we vinegar-and-oil-him,
And O he is delicious stewed with toast.

We eat him with tomatoes, and the salad with potatoes,
 Nor look him o'er with horror when he follows the coldslaw ;
 And neither does he fret us if he marches after lettuce
 And abreast of cayenne pepper when his majesty is raw.
 So welcome with September to the knife and glowing ember,
 Juicy darling of our dainties, dispossession of the clam !
 To the oyster, then, a hoister, with him a royal royster
 We shall whoop it through the land of heathen jam."

The Detroit Free Press, Oct. 12, 1889.

Of all molluscos animals the oyster is commercially the most important, and gastronomically the most delicious. (a) It was said of a cold climate, that no fruit ripened in it "except baked apples;" and Bishop Corbett satirically says, "They never heard of a raw oyster there." The eaters of raw oysters are doubtless beyond all comparison in the ascendancy. Dr. Kitchener, who states that he wrote his "Cook's Oracle" with a knife and fork in one hand and a pen in the other, actually devouring all he described, is a fair specimen of them, but he differed from the majority of oyster eaters, in opening for himself the oysters he so highly enjoyed. "The true lover of an oyster," he remarks, "will have some regard to the feelings of his favourite, and will never abandon it to the mercy of a bungling operator; but will open it himself, and contrive to detach the shell from the fish so dexterously, that the oyster is hardly conscious he has been ejected from his lodging, till he feels the teeth of the piscivorous gourmand tickling him to death." Perhaps, however, even Dr.

(a) Dr. J. G. Jeffreys mentions that Redi, in a letter to his friend Megalotti, describes the *Teredo* as being not only eatable, but excelling all shell-fish, the oyster not excepted, in its exquisite flavour. Nardo also praises it, and wonders why the Venetians, who call it *Bisse del legno*, do not eat it.—"British Conchology," vol. 3, p. 159.

Kitchener did not know that the sweetest morsel of an oyster is the adductor muscle.

You cannot eat the oyster in greater perfection than at a street-stall, because, as the capital of the owner is small, so too is the stock ; and, to be sure of a rapid sale, it must also be well and carefully selected, and therefore does not need the announcement we read in many a by-way one passes along, where "the tale of a tub" would seem to contradict it : "Oysters fresh every day." The poor man has no need to bid his cook, like his wealthy neighbour, buy real sea-water, or salts for the preparation of artificial sea-water, for the preservation of his oysters. There are thousands of hands outstretched to receive his nimble penny, and to give him in return oysters as fine as any which can grace the table of the wealthiest in the land. To me it is a treat to stand by and see how rapidly oyster after oyster disappears down the capacious throat of some stalwart son of toil, and to think that my favourite health-giving mollusc, in every one that is swallowed, is adding strength and muscle to those upon whom we so greatly depend for the nation's wealth and prosperity.

People generally, however, are somewhat indifferent about the manner of opening oysters, and the time of eating them after they are opened ; yet nothing deserves more consideration at the hands of your true oyster-eater. The oyster should be eaten the moment it is opened, if eaten raw, with its own liquor in the undershell, as I have already stated on very high gastronomical authority. It is well worth a little practice to learn to open the oyster oneself, for a bungling operator injures our little favourite, and baulks the expectant appetite by his unsightly incisions.

"I learnt the art," says the author of "The Oyster," &c., "years ago, in one of the Midland Counties, where Christmas-eve would scarce be Christmas-eve without an oyster supper. Let me sketch the scene. In the centre of the table, covered with a clean white cloth up to the top hoop, stands the barrel of oysters, a kindly remembrance from a friend, and the more kind because oysters are not found in fresh-water streams. Each gentleman at table finds an oyster-knife and a clean coarse towel by the side of his plate, and he is expected to open oysters for himself and the lady seated by his side, unless she is wise enough to open them for herself. By the side of every plate is the *panis ostrearius*, the oyster-loaf made and baked purposely for the occasion, and all down the centre of the table, interspersed with vases of bright holly and evergreens, are plates filled with pats of butter, or lemons cut in half, and as many vinegar and pepper castors as the establishment can furnish. As the attendance of servants at such gatherings is usually dispensed with, bottled Bass or Guinness, or any equally unsophisticated pale ale or porter, is liberally provided; and where the means allow, light continental wines, such as Chablis, Sauterne, Mosseux, Marsault or Medoc, still Champagne, Moselle, or any light Rhenish wine, and failing any of these, Madeira or Sherry are placed upon the table. In this list is contained the names of such wines only as are best suited to enhance the taste of the oyster, and to assist digestion. Of spirits, only good English gin, genuine Schiedam, or Irish or Scotch whisky, are admissible, as rum and brandy taken upon oysters will almost always be sure to make them indigestible; and liqueurs are quite out of place."

The ancients ate oysters raw and cooked in various ways, some preferring the raw dainties, others some made

dish. Again, as to their medicinal properties, there was much difference of opinion. Mnesitheus, in his treatise on comestibles, says oysters, cockles, and mussels, and similar things, are not very digestible, because of a sort of saline moisture, which has a peculiar effect on the bowels. Roasted oysters, he says, if cleverly done, are very free from any sort of inconvenience, for all the evil properties are destroyed by the fire. That some Romans had a delicate perception of different qualities in oysters is as probable as the fact is now certain as to many among ourselves ; and hence it is not a mere satire of Montanus :—

“ He, whether Circe’s rock his oysters bore,
Or Lucrine Lake, or distant Richborough’s shore,
Knew at first taste.”

The description will, doubtless, apply to many a Roman banquet :—Around stood silver dishes containing asparagus, *lactuca*, radishes, and other productions of the garden, in addition to *lacerta*, flavoured both with mint and rue, and with Byzantine *muria*, and dressed snails and oysters, while fresh ones in abundance were handed round. The company expressed their admiration of their host’s fanciful invention, and then proceeded to help themselves to what each, according to his taste, considered the best incentive of an appetite. At the same time slaves carried round in golden goblets the *mulsum*, composed of Hymettian honey and Falernian wines. (b) This description is strictly correct, as the Romans ate oysters not only raw, but cooked in various ways.

Macrobius clearly distinguishes between two kinds of oysters which were handed to the guests, and of which they partook or not, at their pleasure. One he points out

(b) Becker’s “ Gallus.”

as *ostrea crudæ*, obviously raw oysters; but the others he mentions in connection with the dish that held them, the *patina ostrearum*, which was a warm dish, prepared from oysters: for *patina* does not signify the dish only in which the meats were served, but a covered bowl in which they were cooked, as well as placed on the table. (c)

A peculiar kind of bread was eaten with oysters, called by Pliny *panis ostrearius*, but in what its peculiarity consisted we are nowhere told.

Apicius gives the following receipts for cooking oysters:—(1). “Pepper, lovage, (d) the yolk of an egg, vinegar, liquor from oysters, oil and wine; you may add honey if you like.” (e).—(2). “Oysters seasoned with cummin, pepper, lovage, parsley, dry mint, malobathrum leaves, cummin in greater proportion, honey, vinegar, and oyster liquor.”

Oysters may be eaten in various ways, either cooked or raw:—

“The pepper-box, the cruet, wait,—
To give a relish to the taste;
The mouth is watering for the bait
Within the pearly cloisters cased.

“Take off the beard,—as quick as thought,
The pointed knife divides the flesh;
What plates are laden! Loads are brought,
And eaten raw, and cold, and fresh.” (f)

(c) “Silver-shell; or The Adventures of an Oyster,” p. 97.

(d) Lovage (*ligusticum*) is an umbelliferous plant of strong aromatic flavour; it is the *Ligusticum levisticum* of Linnæus. A species, the *Ligusticum Scoticum*, is found in Scotland, Ireland, and the north of England.

(e) De Opsoniis, 9, cap. 6. In *Ostreis*.

(f) Hone’s “Every Day Book,” vol. 2, p. 1071.

The oddest way of cooking an oyster, of which we have any mention, is that recorded by Evelyn, who, in the year 1672, saw Richardson, "the famous fire-eater," perform wondrous feats, one of which was, "taking a live coal on his tongue, he put on it a raw oyster; the coal was blown on with bellows, till it flam'd and spark'd in his mouth, and so remained till the oyster gaped, and was quite boil'd." Who ate the oyster thus cooked, we are not informed. (*g*)

The Chinese seldom eat fresh oysters: they are usually dried. They are first boiled for a short time, and then either exposed to the sun, or dried over a slow fire until they look like mushrooms, and give off a nasty rancid smell. When they are eaten fresh, they are taken with ginger and vinegar, and a sauce is made by boiling down the water in which oysters have previously been boiled. (*h*)

"*Oyster Soup*.—Take fifty oysters; blanch them, but do not let them boil; strain through a sieve, and save the liquor. Put a quarter of a pound of butter into a stew-pan; when it is melted, add six ounces of flour; stir it over the fire for a few minutes; add the liquor from the oysters, two quarts of veal stock, one quart of new milk; season with salt, peppercorns, a little cayenne pepper, a blade of mace, Harvey's sauce and essence of anchovy, a tablespoonful of each; strain it through a tammy, let it boil ten minutes; put the oysters into the tureen, with a gill of cream, and pour the boiling soup upon them." (*i*)

Gower Recipe for Oyster Soup.—Boil four sheep's feet in two quarts of water, till reduced to one quart; it will

(*g*) "Evelyn's Memoirs," vol. 1, p. 438.

(*h*) "Flight of the Lapwing."

(*i*) Murray's "Modern Cookery."

then be a stiff jelly ; put in it, while boiling, a small blade of mace ; take off the fat, and thicken it with one and a half tablespoonfuls of ground rice ; add from twenty to fifty oysters ; boil it till thick enough, and add a teacupful of cream.

Oyster Soup is also particularly good when made with a fish stock ; as, for instance, with equal quantities of flounders, skate, and eels, or indeed with any fish that is abundant, and not much in request for other purposes.

Oyster Soup.—Take four dozen oysters ; lay the fish apart, and pass the liquor through a sieve into a stew-pan ; set it on the fire ; beat up the yolks of six eggs, and stir them in with half a pint of cream ; add water or milk to the required quantity ; season with pepper, a little grated lemon-peel, and the flesh of an anchovy beaten up, with a little butter and a small teaspoonful of good arrowroot. Five minutes before serving, put in the oysters. (j)

Potage à la Poissonnière.—Blanch and beard two dozen of oysters, and four dozen of very fresh mussels ; put a quarter of a pound of butter into a stew-pan, with six ounces of flour, make a white *roux* ; when cool, add the liquor of the oysters, mussels, and bones of a sole, with two quarts of broth and three pints of milk ; season with a spoonful of salt, one ditto of sugar, a sprig of thyme, parsley, two bay leaves, four cloves, and two blades of mace ; pass through a tammy into a clean stew-pan ; boil and skim well ; cut about ten pieces of salmon into thin slices, half an inch long, a quarter of an inch wide ; cut the fillet of the sole the same size ; put all into the boiling soup, with half a handful of picked parsley and a gill of

good cream ; put the oysters and mussels in the tureen, and serve. (*k*)

Oyster Mouth Soup.—Make a rich mutton broth, with two large onions, three blades of mace, and black pepper. When strained, pour it on a hundred and fifty oysters, without the beards, and a bit of butter rolled in flour ; simmer gently a quarter of an hour, and serve. (*l*)

To make an Oyster Soup.—Your stock must be made of any sort of fish the place affords ; let there be about two quarts. Take a pint of oysters, beard them, put them into a saucepan, strain the liquor, let them stew two or three minutes in their own liquor, then take the hard parts of the oysters, and beat them in a mortar with the yolks of four hard-boiled eggs : mix them with some of the soup, put them with the other part of the oysters and liquor into a saucepan, a little nutmeg, pepper, and salt ; stir them well together, and let it boil a quarter of an hour. Dish it up, and send it to table. (*m*)

“ *White Oyster Sauce* (No. 43).—First scald and beard the oysters, and save the liquor. Next knead two ounces of butter, with one ounce of flour (or, better still, with arrowroot), in a stew-pan ; add the liquor, a gill of cream or milk, a little nutmeg, cayenne, anchovy, and lemon-juice ; stir over the fire until the sauce boils, then add the oysters and serve hot.” (*n*)

“ *Brown Oyster Sauce* (No. 44).—Prepare the oysters as in the foregoing recipe, boil down their liquor, add half a pint of brown sauce (No. 12), or, if there is none ready,

(*k*) “ *The Gastronomic Regenerator*,” by M. A. Soyer.

(*l*) “ *All about Oysters*.”

(*m*) “ *The Art of Cookery made Plain and Easy*.”

(*n*) *Francatelli’s “Cook’s Guide.”*

use melted butter instead, adding a little browning ; season with a little anchovy, cayenne, and lemon-juice ; add the oysters ; boil together for a few minutes, and serve hot." (o)

" *Oyster Sauce*.—Set a pint of cream upon the hob, beside a fire of clear glowing ashes, in an earthenware pipkin, glazed inside. Take two ounces of butter, and intimately mix with part of it a teaspoonful of best arrowroot, flavour with the flesh of anchovy, pounded, a dash of cayenne-wine, a squeeze of lemon-juice, and a scrap of peel, and stir in the whole, letting it boil until of the proper consistence ; then put in the oysters (if of a large size they should be cut into halves or quarters), and keep stirring the sauce for about two minutes.—N.B. In mixing the butter with the cream take care that the blending proceeds slowly, and keep stirring gently with a wooden spoon." (p)

" *Old Recipe for making Oyster Sauce*.—Take half a pint of large oysters, liquor and all ; put them into a saucepan with two or three blades of mace, and twelve whole peppercorns ; let them simmer over a slow fire till the oysters are fine and plump, then carefully with a fork take out the oysters from the liquor and spice, and let the liquor boil five or six minutes ; strain the liquor, wash out the saucepan well, and put the oysters and liquor into the saucepan again, with half a pint of gravy and half a pound of butter just rolled in a little flour. Add two spoonfuls of white wine, keep it stirring till the sauce boils, and all the butter is melted."

" *Oyster Atlets*.—Blanch three sweetbreads, and cut them into slices ; then take rashers of bacon the size of

(o) Idem.

(p) Maître Jacques.

the slices of sweetbreads, and as many large oysters blanchèd as there are pieces of sweetbread and bacon. Put the whole into a stew-pan, with a piece of fresh butter, parsley, thyme, and eschalots, chopped very fine; pepper, salt, and lemon-juice, a small quantity of each. Put them over a slow fire, and simmer them five minutes. Then lay them on a dish, and when a little cool, put them upon a small wooden or silver skewer; a slice of sweetbread, a slice of bacon, and an oyster, and so on alternately till the skewers are full; then put bread-crumbs over them, which should be rubbed through a hair-sieve, and broil the atlets gently till done and of a light-brown colour. Serve them up with a little cullis under them, together with the liquor from the blanchèd oysters reduced and added to it." (q)

"*Curried Oyster Atlets*.—Take slices of sweetbreads, or slices of mutton or veal of the same size, put them into a stew-pan with a piece of fresh butter, a tablespoonful of currie-powder, the juice of half a lemon, and a little salt. Set them over a slow fire, and when they are half done, add to them blanchèd and bearded oysters, with their liquor free from sediment, simmer together five minutes, lay them on a dish, and when cold put them alternately on small wooden skewers. Then dip them in the liquor, strew fine bread-crumbs on each side, broil them over a clear fire till of a brown-colour, and serve them up with some curry sauce under them.—N.B. The slices of sweetbread, oyster, veal, or mutton, to be of an equal number." (r)

"*Curried Oysters*.—Let a hundred of large sea-oysters be opened into a basin, without losing one drop of their liquor. Put a lump of fresh butter into a good-sized

(q) "Old Cookery Book."

(r) Idem.

saucepan, and when it boils add a large onion, cut it into thin slices, and let it fry in the uncovered stew-pan until it is of a rich brown ; now add a bit more butter and two or three tablespoonfuls of curry-powder. When these ingredients are well mixed over the fire with a wooden spoon, add gradually either hot water or broth from the stockpot, cover the stew-pan, and let the whole boil up. “ Meanwhile, have ready the meat of a cocoa-nut, grated or rasped fine, put this into the stew-pan with a few sour tamarinds (if they are to be obtained, if not, a sour apple chopped). Let the whole simmer over the fire until the apple is dissolved, and the cocoa-nut very tender ; then add a strong thickening, made of flour and water, and sufficient salt, as a curry will not bear being salted at table. Let this boil up for five minutes. Have ready also a vegetable marrow, or part of one, cut into bits, and sufficiently boiled to require little or no further cooking. Put this in with a tomato or two ; either of these vegetables may be omitted. Now put into the stew-pan the oysters, with their own liquor, and the milk of the cocoa-nut, if it be perfectly sweet ; stir them well with the former ingredients ; boil the curry, stew gently for a few minutes, then throw in the strained juice of half a lemon. Stir the curry from time to time with a wooden spoon, and, as soon as the oysters are done enough, serve it up, with a corresponding dish of rice on the opposite side of the table. This dish is considered at Madras the *ne plus ultra* of Indian cookery.” (s)

“ *To stew Oysters.*—Take the oysters clean from their liquor. Let the liquor stand till it is clear ; then put a little of it to the oysters, and stew them ; then put to them

(s) Miss Acton’s “Modern Cookery Book,” taken from “Magazine of Domestic Economy.”

a little white wine, a little cream, a little lemon-juice, and a bit of butter ; shake them together, then serve." (t)

" *American Box Stew*.—For six people open six dozen of oysters, put them in a basin with their own liquor. Place in a stew-pan a pint and a half of milk and a quarter of a pound of butter, pepper and salt to the taste ; thicken with a teaspoonful of flour, then add the yolks of two eggs ; when boiling throw in the oysters and liquor, let it boil up again ; then pour immediately into six soup plates : in the bottom of each a round of dry toast must have been previously placed. Some prefer two dozen of oysters to each soup plate, instead of one dozen, in which case double the quantity of oysters and their liquor is required, leaving the other ingredients as before." (u)

" *Oysters stewed*.—Wash them in their own liquor, strain them, put them into a saucepan with some white pepper pounded, a little beaten mace, a little cream, a piece of butter mixed with flour ; stir this till it boils, throw in the oysters, simmer them till done enough ; add salt if required ; toasted sippets round the dish." (v)

" *To stew Oysters another way*.—Take a quart of oysters, wash them one by one in their own liquor with a little vinegar and white wine ; then strain the liquor into a saucepan, and put your oysters to it, with a bit of mace, whole pepper, cloves, nutmeg, and a very little thyme and savory, a whole onion, and a little lemon-peel ; cover it close, and let it stew very slowly almost a quarter of an hour ; then make a sauce with six spoonfuls of the liquor, shalot, anchovies, some butter, a little mace, and juice of

(t) MS. Book, taken from "Edible British Mollusca," by M. S. Lovell.

(u) "All about Oysters."

(v) "The Lady's Assistant," by Mrs. Charlotte Mason, 1775.

lemon; wet sippets in the stewed liquor and lay them upon a plate, lay your oysters on them, the best side upwards, and crumble the yolks of two or three hard-boiled eggs over them, so pour on your sauce. Garnish with lemon and barberries." (*w*)

"*Oysters stewed with Milk.*—Take a pint of fine American oysters, put them with their own liquor and a gill of milk into a stew-pan, and, if liked, a blade of mace; set it over the fire, take off any scum which may rise; when they are plump and white, turn them into a deep plate; add a little butter and pepper to taste. Serve crackers and dressed celery with them." (*x*)

"*To stew Oysters the French way.*—Parboil a quart of oysters in their own liquor, wash them in warm water, beard them, and put them into a pipkin with a little of their own liquor, white wine, salt, pepper, and a whole onion, and let them stew till they are done enough; then put them, liquor and all, into a frying-pan, and fry them a little; then put in a lump of fresh butter, and fry a little longer; then take the yolks of four eggs dissolved in vinegar, with minced parsley and grated nutmeg, put these into the frying-pan to the oysters, shake them, let them have a walm (*sic*) or two, and serve them." (*y*)

"*Dutch Oysters.*—Roll rock oysters in yolk of egg, then dip them in grated bread-crumbs and white pepper, one by one, and fry them in butter. Serve them with melted butter in a sauce tureen." (*z*)

(*w*) "The Lady's Companion," 1753, vol. 2, p. 154.

(*x*) Mrs. Crowen's "American Lady's Cookery Book."

(*y*) "The Lady's Companion," 1753, vol. 1, p. 164.

(*z*) "The English Cookery Book," ed. by J. H. Walsh.

“ *To fry Oysters.*—Take the largest oysters, open them, but do *not mangle them*, wash them in their own liquor, and take away all bits of shells; strew a little flour over them. Dip them in the yolk of an egg, and fry them brown in butter.”

“ *To fry Oysters another way.*—Beat four eggs with salt, add a little nutmeg grated, and a spoonful of grated bread, then make it as thick as batter for pancakes, with fine flour; drop in the oysters, and fry them brown in clarified beef suet. They are to lay round any dish of fish.” (a)

“ *To fry Oysters.*—Take two quarts of large oysters, parboil them in their own liquor, then wash them in warm water, dry them, beard them, and flour them; then fry them crisp in clarified butter; then lay in the dish prawns or shrimps buttered with cream and sweet butter, and lay the fried oysters about them; run them over with beaten butter and the juice of oranges; lay bay-leaves and orange or lemon in slices round the oysters.” (b)

“ *To fry Oysters.*—Open large oysters, and lay them on a sieve to drain; then put them into a marinade of the juice of three or four lemons, and a sliced onion, pepper, a little basil, a bay-leaf, and five or six cloves. Turn the oysters often when they lie in this marinade. Then make a batter with flour and water, and one egg and a little salt. Beat these well together; melt a bit of butter as big as a walnut, and mix it with your batter; then take your oysters out of the marinade, and dry them well between two napkins, dip the oysters in the batter, and fry them in clarified butter made very hot. When they are fried brown, serve them on a clean napkin, with fried parsley.” (c)

(a) “The Housewife’s Pocket Book.”

(b) “Cook’s and Confectioner’s Dictionary,” John Nott.

(c) Idem.

“*Fried Oysters—Ostras Asadas*, Spanish recipe.—Take the fish out of the shells, and simmer slowly for some minutes in their own liquor. Add salt, pepper, parsley chopped fine, a clove of garlic, some oil or butter, in which fry them gently; stir in a spoonful of flour, and moisten them with equal quantities of broth and wine. When done, add the juice of a lemon.”

“*Fried Oysters; another way*.—Beat up two or three eggs in a cup, and rasp bread-crumbs on a plate, with sweet herbs powdered, and lemon-peel. Dry the oysters as much as possible, souse them in the egg, and cover them with crumbs. Fry them in plenty of good butter, and serve with lemon-juice, cayenne, and brown bread and butter, cut thin.” (d)

“*A Ragout of Oysters*.—Melt some butter, put in a little flour; keep it stirring till brown; wet it with gravy; put in a crust with the oysters and liquor; toss it; season with pepper, parsley, and fish broth.”

“*A Ragout of Oysters—Ostras Guisadas*, Spanish recipe.—Put the liquor of the oysters into a saucepan, with strong broth, and warm it, salt to your taste; then add the oysters and a chopped anchovy or two; let them simmer, but not boil; serve with chicken, or white meat.”

“*Grilled Oysters*.—Open and detach the largest oysters; place upon each a small piece of butter, well mixed with finely chopped parsley and spices; place them on the gridiron, and when they begin to boil, serve them on a dish; or else detach the oysters from their shells, and let them simmer in their own liquor; take them out, and let them be placed again over the fire, with a piece of butter, parsley, some pepper, and a little lemon-juice. Put four oysters into each shell (after it has been well cleansed),

(d) Maître Jacques.

and place the shell on the gridiron again for a few minutes, taking care not to let them boil up.” (e)

“*Oysters Broiled the Dutch way.*—Take two quarts of large oysters, open and parboil them in their own liquor; strain them, and then put them into a pipkin, with some mace, butter, and slices of onion; stew them, and after that place the shells on a gridiron, and put two or three oysters into a shell; let them broil or stew in their own liquor, and so setting them on plates, fill them with well beaten butter, and serve them up.” (f)

“*To Roast Oysters* (206).—Place the oysters unopened between the bars of a fire, or in a charcoal stove. They require about six or eight minutes time.” (g)

“*Oysters Roasted.*—Take large oysters and spit them upon little long sticks, and tie them to the spit, lay them down to the fire, and when they are dry, baste them with claret wine; put into the pan two anchovies, and two or three bay leaves; when you think they are sufficiently done, baste them with butter, and dredge them, and take a little of the liquor out of the pan, and some butter, and beat it in a porringer, and pour over them.” (h)

“*Oysters Roasted, American recipe.*—Wash the shells perfectly clean, wipe them dry, and lay them on a gridiron, the largest side to the fire; set it over a bright bed of coals; when the shells open wide, and the oysters look white, they are done; fold a napkin on a large dish or tray, lay the oysters on it in their shells, taking care not to lose the juice; serve hot.

(e) “*La Cuisinière de la Campagne.*”

(f) “*The Family Dictionary*,” by William Salmon; 1710.

(g) “*The English Cookery Book.*”

(h) “*The Family Dictionary.*”

“When oysters (large American ?) are served roasted at supper, there must be a small tub between each two chairs, to receive the shells, and large coarse napkins called oyster napkins. Serve cold butter and rolls, or crackers, with roasted oysters.” (i)

Men about town in New York have introduced a new way of dressing oysters before eating them. Instead of using salt, pepper, or catsup, the raw oyster is covered with sugar, and with the aid of a little lemon juice it is ready to eat. The new style was introduced by a Chinaman, and was quickly taken up by lovers of the bivalves.

“*Oysters—Ostras à la Pollada*, Spanish recipe.—Take oysters out of their shells, and blanch them in boiling water; then throw them into cold water, and take them out and let them drain. Put into a saucepan a piece of butter mixed with flour, parsley chopped fine, and mushrooms; warm this over the fire, and add sufficient broth to moisten it, and when it is thickened sufficiently, add the oysters seasoned with pepper and salt, and let the whole boil. The moment before serving add the juice of a lemon, or a little vinegar.”

“*Boiled Oysters*.—Wash the shells nicely, and put them into a pot or pan, with the edges downwards; put a pint, or a little less, of water to them, and put them over a brisk fire. As soon as the shells open wide, take them off, and take out the shells; then take up the oysters with a skimmer, and put them into a deep dish; put to them some of the liquor which boiled from them; add to it butter and pepper to taste, and serve with rolls, crackers, or toast. For persons in delicate health, this manner of preparing oysters is both light and healthful.” (j)

(i) Mrs. Crowen's “American Lady's Cookery Book.”

(j) Idem.

“*Oyster Sausages*.—Mince a pint of oysters, scalded so as to make them hard, and also a pound of lean sirloin of beef, and mix them ; season with pepper, salt, and mace ; mix up well with the yolks of eight eggs, shape them like sausages, and fry in butter.” (k)

“*To make Oyster Sausages*.—Take the flesh of the inside of a loin of mutton, and chop it as for force-meat, and season it with spice ; then put to it fifty oysters chopped very small, with a little French bread grated, and the yolks of four eggs, with a little chopped onion, a little beef-suet, and a little lemon-peel. *Roll* it into what form you please, and, if you do not use it, cover it up, and it will keep for a long time.”

“*To Mince Oysters*.—Take half a hundred oysters, and put them into warm water ; when they are ready to boil, shift them into cold water ; then drain them, and take that part only which is tender. If you mix the flesh of carp with your oysters, it will increase your mince, and give it a better flavour. Put a bit of butter, shred parsley, scallions, and champignons, into a stewpan, and shake them over the fire, add a little flour, and moisten them afterwards with a gill of white wine, and as much *soupe maigre* ; then put in your mince, and let it stew till the sauce be consumed ; season it agreeably, and when you are ready to serve it, put in the yolks of three eggs ; beat up with some cream.” (l)

“*Oyster Force-meat*.—Open carefully a dozen fine oysters, take off the beards, strain their liquor, and rinse the oysters in it ; grate four ounces of the crumb of a stale loaf into light crumbs, mince the oysters, but not too small, and

(k) Maître Jacques.

(l) “The French Family Cook.”

mix them with the bread ; add an ounce and a half of good butter, broken into minute bits, the grated rind of half a small lemon, a small saltspoonful of pounded mace, some cayenne, a little salt, and a large teaspoonful of parsley. Mingle these ingredients well, and work them together with the unbeaten yolk of an egg, and a little of the oyster liquor, the remainder of which can be added to the sauce, which usually accompanies this force-meat." (*m*)

"*Oysters and Chestnuts.*—Dip some oysters into a savory batter ; bread-crumble them, and fry them brown. In the same manner treat a similar number of blanched Spanish chestnuts. Make a sauce with the oyster liquor, a piece of butter rubbed in flour, and two glasses of white wine. Stew the chestnuts in this ; add some yolk of egg to thicken it, and pour it upon the oysters." (*n*)

"*Oyster Steak.*—Take a steak double the usual thickness, and with a very sharp knife divide it in the centre from one side only, so as to form a sort of bag. Open sufficient oysters to stuff the bag ; season with salt and pepper ; add a lump of butter and some of the oyster liquor ; sew it up carefully, put it on a gridiron, let it gradually cook so as to warm the oysters right through. Serve hot with butter, pepper, and salt." (*o*)

"*Scalloped Oysters.*—Scald and beard some dozens of oysters ; strain the liquor into a stew-pan, and add thereto two ounces of butter, mixed or kneaded with two ounces of flour, a little cream, anchovy, nutmeg, and cayenne ; stir the sauce over the fire to boil, and reduce for ten minutes ; then add a couple of yolks of eggs, and a little lemon-juice

(*m*) Miss Acton's "Modern Cookery."

(*n*) "Household Manuals : How to Cook Fish," by Georgiana Hill.

(*o*) "All about Oysters."

and some chopped parsley; add the oysters, cut each in halves; stir all together over the fire for a few minutes, and fill some scallop-shells with this preparation; cover them over with a thick coating of fried bread-crumbs; place them on a baking-sheet in the oven for five minutes, and serve hot." (*p*) If you have no scallop-shells, the deep shell of the oyster, well scoured, will serve the purpose.

Many people, however, who prefer the real taste of the oyster, and do not like to conceal it beneath that of spice, prefer the old-fashioned way of scalloping oysters, which is as follows:—

"*Old way of Scalloping Oysters.*—Beard the oysters; scald the beards in the liquor from the fish, then strain them off; lay alternate layers of bread-crumbs, oysters, and small bits of butter in the shells, very slightly peppering them as you proceed. Pour the liquor in which you scalded the beards over them; put them into the oven till nicely browned, and if you find the colour not bright enough, put them before a fire for a few minutes, or salamander them. A little cream, added after the shells are filled, but before they are put in the oven, is a great improvement." By lining the dish, and covering the oysters with puff paste, this is converted into an *Oyster Pie*, which makes an excellent dish.

"*Scalloped Oysters—Ostras en Concha*, Spanish recipe.—Select the largest shells, and scrub them very clean; put four or six oysters into each, with their liquor, and cover them with bread-crumbs, seasoned with pepper and salt; then place the shells on the gridiron till the fish is cooked."

"*Oyster Fritters* (2997).—Make a batter of flour, milk, and eggs; season with a very little nutmeg. Beard the

(*p*) Francatelli's "Cook's Guide."

oysters, and put as many as you think proper in each fritter." (*g*)

"*Oyster Loaves*.—Open the oysters, and save the liquor ; wash them in it ; then strain it through a sieve, and put a little of it into a tosser, with a bit of butter and flour, white pepper, a scrape of nutmeg, and a little cream ; stew them, cut in dice ; put them into rolls sold for the purpose." (*r*)

"*An Oyster Loaf*.—Cut round holes in the tops of French rolls ; take out all the crumb, rub them over the sides with a tender force-meat made of fat oysters, part of an eel, pistachio nuts, mushrooms, spice, and the yolks of two hard eggs ; beat these well together in a mortar, with a raw egg ; then fry the rolls crisp in lard, and fill them with a quart of oysters ; the rest of the eel cut like lard, spice, mushrooms, and anchovies tossed up in their own liquor, and half a pint of white wine ; thicken it with eggs, and a bit of butter rolled in flour." (*s*)

"*Oysters and Macaroni*.—Lay some macaroni in a deep dish ; put upon it a thick layer of oysters, bearded, and seasoned with cayenne pepper and grated lemon-rind. Add a small teacupful of cream. Strew bread-crumbs over the top, and brown it in a pretty quick oven. Serve hot with a piquant sauce." (*t*)

"As you open the oysters separate them from the liquor, which strain ; parboil them, after taking off the beards ; parboil sweetbreads, and cutting them in slices, lay them

(*g*) "Enquire within upon Everything."

(*r*) "The English Cookery Book."

(*s*) "The English Cookery Book."

(*t*) "The Housekeeper's Pocket Book."

and the oysters in layers ; season very lightly with salt, pepper, and mace ; then put half a teacupful of liquor, and the same of veal gravy. Bake in a slow oven ; and before you serve put in a teacupful of cream, a little more oyster liquor, all warmed but not boiled.” (u)

“ *An Oyster Pie* (old recipe).—Parboil a quart of large oysters in their own liquor ; mince them small, and pound them in a mortar with pistachio-nuts, marrow, and sweet herbs, an onion, savory, spices, and a little grated bread ; lay on butter, and close your pie.” (v)

“ *Oyster Pie, another way*.—Take a large dish, butter it, spread a rich paste over the sides, and round the edge, but not at the bottom ; the oysters should be fresh, and as large and fine as possible ; drain off part of the liquor from the oysters ; put them into a pan, season them with pepper, salt, and spice ; stir them well with the seasoning ; have ready the yolks of eggs, chopped fine, and grated bread ; pour the oysters (with as much of their liquor as you please) into the dish that has the paste in it ; strew over them the chopped egg and grated bread ; roll out the lid of the pie, and put it on, crimping the edge handsomely. Bake the pie in a quick oven.”

“ *Oyster and Eel Pie* (old recipe).—Make puff paste and lay it in your dish ; then take great eels and flay them, clean them, cut them in pieces, and wash them dry. Lay some butter in your pie, and season your eels with some pepper, salt, nutmeg, cloves, and mace, and put them in ; cover them all over with great oysters, and add more of your beaten spices and salt ; cover the whole with butter, and put in two or three spoonfuls of white wine ; so close it with paste, bake it, and serve it in hot.”

(u) “Household Manuals : How to Cook Fish.”

(v) Murray’s “Modern Domestic Cookery.”

“ *Oyster and Parsnip Pie*.—Boil the parsnips tender and cut them in slices, then line your dish with good paste, and lay upon it some pieces of butter, then a layer of parsnips, some spice, pepper, &c., then some oysters and yolks of hard-boiled eggs, then more butter and spice, &c., then parsnips, then oysters, eggs, &c., until your dish is filled. Put butter on the top of all, and cover it all with paste ; bake half an hour or so, and when it comes out of the oven, pour over it melted butter and juice of lemon, and serve hot.”

“ *Pickled Oysters*.—Put two dozen of large oysters into a stew-pan over a fire, with their liquor only, and boil them five minutes ; then strain the liquor into another stew-pan, and add to it a bay-leaf, a little cayenne pepper, salt, a gill and a half of vinegar, half a gill of ketchup, a blade of mace, a few allspice, and a bit of lemon peel ; boil it till three parts reduced, then beard and wash the oysters, put them to the pickle, and boil them together two minutes. When they are to be served up, place the oysters in rows, and strain the liquor over them ; garnish the dish with slices of lemon or barberries.” (w)

Glamorganshire way of Pickling Oysters.—Beard them nicely ; then slowly stew them in the liquor from their shells, with a bay-leaf or two, and some whole black pepper ; a very small quantity of vinegar is then added, and they are placed in stone jars, corked, and covered with pitch. They are then ready for the London markets. This oyster pickling may be seen going on in almost every cottage. The oysters when raw sell at 1/- the hundred, and when pickled at about 1/9, or even at 2/-.

(w) From an old Cookery Book.

Soyer's Recipe for Pickling Oysters for the London Markets.—"Put the oysters, with their liquor, in an earthen pan on the fire, to simmer; take off the scum as it rises; add some whole pepper, sliced ginger (green if possible), a few cloves, some chopped chillies, and a little vinegar; simmer not longer than five minutes, and take them out; remove the beards, and put the oysters in a barrel, and when the liquor is cold, strain and add it."

"*Pickled Oysters—Ostras en Escabechados.* Spanish recipe.—Make a pickle of the liquor of the oysters, chopped onions, parsley, garlic (this, of course, may be omitted if not liked), bay-leaves, marjoram, salt, pepper, butter into which flour has been rubbed, and a few drops of vinegar; when well thickened by boiling, add the oysters, and stir gently."

"*Oyster Powder.*—Open the oysters carefully, so as not to cut them, except in dividing the gristle, which attaches the shells; put them into a mortar, and when you have got as many as you can conveniently pound at once, add about two drachms of salt to about a dozen oysters; pound them, and rub them through the back of a hair sieve, and put them into a mortar again, with as much flour (but previously thoroughly dried) as will roll them into a paste; roll this paste several times; lastly flour it, and roll it out the thickness of a half-crown, and cut it into pieces about one inch square; lay them in a Dutch oven, where they will dry so gently as not to get burned; turn them every half-hour, and when they begin to dry, crumble them; they will take about four hours to dry; pound them, sift them, and put them into dry bottles: cork and seal them. Three dozen of natives require seven and a half ounces of flour to make them into a paste weighing eleven ounces,

and when dried six and a half ounces. To make half a pint of sauce, put one ounce of butter into a stew-pan, with three drachms of oyster powder and six tablespoonfuls of milk; set it on a slow fire, stir it till it boils, and season it with salt; as a sauce it is excellent for fish, fowls, or rump-steaks. Sprinkled on bread-and-butter it makes a good sandwich." (x)

"*Another Oyster Powder.*—When the oysters are prepared by simmering in their own liquor, cut them across in thin slices; dry them crisp, that they may be reduced to fine powder. Pack and use them for sauces, as truffles or morels." (y)

"*Oysters on Toast.*—Open oysters, put them in a pan with their liquor, a quarter of a teaspoonful of pepper, a wine glass of milk, two cloves, and a small piece of mace, if handy; boil a few minutes until set; mix one ounce of butter with half an ounce of flour; put it (in small pieces) in the pan; stir round, when near boiling pour over the toast and serve. A little sugar and the juice of a lemon is a great improvement." (z)

"*Oyster Toast.*—Beard and pound a few oysters in a mortar; when they form a paste add a little cream, and season them with pepper; get ready some nice pieces of toast, spread the oyster paste upon them, and place them for a few minutes in an oven, to become warm. A little finely chopped pickle may be thrown upon the tops." (a)

"*Oyster Ketchup.*—Pound the fish, and add to each pint of them one pint of sherry wine, one ounce of salt, pow-

(x) "Enquire within upon Everything."

(y) "Indian Domestic Economy."

(z) "All about Oysters."

(a) Idem.

dered mace two drachms, pepper one drachm. Boil up, skim, strain; add to each pint two teaspoonfuls of brandy, then bottle, to flavour sauces when oysters are out of season." (b)

"*Oysters au Gratin*.—Set a little cream in a pipkin, with a piece of butter (the quantities to be judged according to the size of the dish), and mingle them gradually; add to this a little anchovy sauce, cayenne, wine, and grated lemon-peel. Pour half of this in a dish, lay in the oysters, and grate over them a little Parmesan cheese and bread-crumbs (not too thick a layer), seasoned in the usual way; then pour over the rest of the cream and butter, and grate another thin layer of Parmesan and bread-crumbs. Set it in a quick oven or in a Dutch oven." (c)

In the Mediterranean, a species of oyster, viz., *Spondylus gædaropus*, is eaten both in Spain and in Italy. The Spanish names for it are *Ostra vermella*, or *Ostra vermeya*, and the Italian, *Spuonnolo* and *Copiza*.

In closing this chapter, let me remind all cooks that the success in preparing the above-mentioned dishes depends on the goodness and freshness of the oysters used for this purpose. Very erroneous is the opinion that oysters which are not fresh are yet good enough to be fried and to be used for sauces. The greatest delicacy is a fresh oyster, but a stale one is a source of the greatest disgust, and only fit to regale the ghost of that Royal George who, when living, never relished a raw oyster unless the shell was self-opened on the dish.

(b) "Dictionary of Practical Receipts," by G. W. Francis.

(c) Maître Jacques.

CHAPTER XVI.

THE OYSTER AND THE DOCTOR.

CURIOSITIES OF FOOD—THE FIRST OYSTER-EATER—PHILOXENUS AND THE POULPE—THE SPECULATIONS OF A HUMAN STOMACH ON OYSTERS—SPECIES OF OYSTERS USUALLY EATEN—OPINIONS OF DOCTORS (ANCIENT AND MODERN)—SECRET OF THE OYSTER'S DIGESTIBILITY—CHEMICAL ANALYSIS—HOW LONG OYSTERS WILL KEEP THEIR FLAVOUR—OYSTER-EATING IN PRUSSIA—DISGUSTING WAGERS—OYSTERS BETTER THAN PILLS—A UNIVERSAL REMEDY—WHEN LADIES SHOULD EAT THEM—REPUGNANCE OVERCOME—OYSTERS AS AN EXTERNAL APPLICATION—APICIUS AND LUCULLUS—GUIDE TO DIGESTION—HOW TO TELL IF DEAD BEFORE OPENING.

THE proverbial saying that "What is one man's meat may be another man's poison" has its verification within the limits of many a family circle. But it has a national as well as an individual significance, and it has even a wide racial meaning.

The Mongol, for instance, fares sumptuously and with keen relish on many things from which the Caucasian turns with sickening disgust. There is as much diversity of liking as to things edible between the Ethiopian and the American Indian, and the pangs of starvation would hardly tempt an Afghan to indulge what a Terra del Fuegian would consider a delicacy. But, however wide

the circle of observation in such matters may be drawn, it is doubtful if the proverb justifies itself more in any one thing than it does in the case of fungi. What we would consider poisonous fungi are regarded by the Italians as highly nourishing, while the variety we eat is condemned by their market inspectors as unfit for food. Not without reason is this course taken. It seems that mushrooms vary in character and in consequent physical effects according to the soil from whence they spring, and the variation is decided enough in Italy, particularly in the Papal States, as compared with England, to transform the properties of this article.

Several forms of animal and vegetable life of a highly nutritious character, that can be had in abundance in this country, are through ignorance or prejudice pronounced unclean and unpalatable.

Take snails for instance. Such a conservative thing is our English dietary that it is hard to conceive of a condition of existence short of absolute famine that would induce our people to appease their hunger with anything so repugnant to their ideas of suitable food as the animals just mentioned, and yet there is a pretty free consumption in all our towns of marine varieties of this very creature. As we indulge in fresh-water as well as in salt-water fish, it seems singular that we should abhor the land-snail while smacking our lips over that sent up to our markets from tidal waters.

Our continental neighbours are glad to have every variety of creature, and, if anything, have a preference for the land species. In truth, if a choice is to be made, the land snails ought decidedly to be preferred to the sea ones.

They are infinitely more delicate in fibre and flavour, and being for the most part vegetable feeders, they are far more cleanly in their habits.

Analysed as food, snails are said to contain 70 per cent. of water, 16 per cent. of nitrogen, 7 per cent. of fat, 2 per cent. of salts, and 5 per cent. of undetermined matter. Many adulterations much more reprehensible than the use of snails enter into the food we are compelled to consume. Their wholesomeness is unquestionable.

There is, however, no reasoning with prejudice. Nor are snails the only free food which is rejected. Eels are frequently held in equal dislike, from a sort of idea that they are water-snakes.

And, lastly, of the frog, the Parisians eat the hind legs; the Germans, all muscular parts; the Viennese, almost any species suitable for table.

I have been tempted to make these remarks relative to the *Curiosities of Food*, simply to prove that a similar prejudice exists in the minds of many people with regard to oysters, and it is with the hope of conquering this prejudice (if my reader be unfortunate enough to have such) that this chapter is written.

“Oysters,” says old Fuller, “are the only meat which men eat alive, and yet account it no cruelty.” The idea of eating any creature whilst still alive does, it must be confessed, savour a little of ferocity, and, as King James was wont to say, “He was a very valiant man who first ventured on eating of oysters;” (*a*) or, as the poet Gay

(*a*) Similar is the language of the German physician Linsenbahr, or Lentulus as he is more frequently called, who appears to have held very decided opinions in his day, and to have abominated the “breedy creatures,” of which he thus speaks:—“Animal est aspectu et horridum et nauseosum, sive id spectes in sua concha clausum, sive apertum, ut audax fuisse credi queat, qui primum ea labris admovit.”

has sung of the first raw-oyster eater in the well-known lines :—

“ That man had sure a palate covered o’er
 With brass or steel that on the rocky shore
 First broke the oozy oyster’s pearly coat,
 And risked the living morsel down his throat.”

The popular idea with regard to eating raw oysters is that the animal is killed as soon as

“ The damsel’s knife the gaping shell commands,
 And the salt liquor streams between her hands.”

But this is a mistake ; if the oyster is not dead before it is opened, it is undoubtedly swallowed alive.

King James’s haphazard guess relative to the proto-oyster-eater, is—taking it from our fastidious point of view concerning food—quite correct, and, consistently with my subject, worthy a brief notice.

To begin with, then, let us ask who and what was he ? We know not. Time has not saved his name from oblivion ; Tradition has not echoed it ; nor History falsified one for that benefactor to the Human Race, who, had he been a Greek or Roman, would assuredly have received the honour of deification at the hands of his noble fellow-countrymen, for they who could, in gratitude to the geese whose cackling “ saved the Eternal City,” hold those birds sacred for ever after, would certainly have apotheosized our unknown hero. We must conclude, then, that he lived ages upon ages since,

“ — free as Nature first made Man !
 Ere the base laws of servitude began,
 And wild, in woods, the noble Savage ran.”

Upon what grounds do I come to this conclusion ? Upon the revelations of Geology ; and the fact that the kitchen-middens of the prehistoric period, found in Northern

Europe and elsewhere, bear testimony to the use made of this mollusc for food by the primitive inhabitants of this globe of ours.

But, if we have no record of this courageous individual, we have, at least, a legend concerning him, which, I am led to hope, will interest my reader.

“Once upon a time a man of melancholy mood was walking by the shores of a picturesque estuary, listening to the monotonous murmur of the sad sea-waves, when he espied a very old and ugly oyster-shell, all coated over with parasites and sea-weeds. It was so unprepossessing that he kicked it with his foot, and the animal, astonished at receiving such rude treatment on its own domain, gaped wide with indignation, preparatory to closing its valves still more tightly. Seeing the beautiful cream-coloured layers that shone within the shelly covering, and fancying that the interior of the shell itself must be beautiful, he lifted up the aged ‘native’ for further examination, inserting his finger and thumb within the valves. The irate mollusc, thinking, no doubt, that this was meant as a further insult, snapped its pearly doors down upon his fingers, causing him considerable pain. After releasing his wounded digits, our inquisitive gentleman very naturally put them in his mouth. ‘Delightful!’ exclaimed he, opening wide his eyes; ‘what is this?’ and again he sucked his fingers. Then the great truth flashed upon him that he had found out a new delight—had, in fact, achieved the most important discovery ever made. He proceeded at once to realise the thought. With a stone he opened the oyster’s stronghold, and gingerly tried a piece of the mollusc itself. ‘Delicious!’ he exclaimed: and there and then, with no other condiment than its own juice, with no accompaniment of foaming brown stout or

pale chablis to wash it down, no newly-cut, well-buttered brown bread, did that solitary anonymous man inaugurate the first oyster banquet." (*b*) And ever since men have gone on eating oysters. Emperors and poets, princes and priests, pontiffs and statesmen, orators and painters, have feasted on the favoured bivalve.

Well, as I have said, looking at it from our point of view, he *was* a bold man. But Dr. Johnston gives us the story of a Greek whose disposition quite equalled, if it did not excel in courage, that of our first oyster-eater:—

"Of all fish-eaters,
None, sure, excelled the lyric bard Philoxenus.
'Twas a prodigious twist! At Syracuse
Fate threw him on the fish called 'many-feet.' (*c*)
He purchased it and drest it: and the whole,
Bate me the head, formed but a single swallow."

And, after this, who can wonder that "a crudity ensued," and that the visit of "the doctor" was deemed advisable.

But to return to our oyster-eater. The picture drawn in the legend is quite up to the standard (as far as its brevity will admit) of "Hero worship" in the abstract, but although I admit that the anonymous prehistoric gentleman in question fully deserves a novel in his honour, I think old Fuller's version of the matter comes nearer the truth.

(*b*) "The Ocean World," p. 379, and quoted from "The Harvest of the Sea;" but in my edition of the latter work (the third) there is no such passage.

(*c*) So was it called in ancient times. It is a kind of Octopus (*O. vulgaris*), for which the common name is the "poulpe." Animals of this kind, classed among oysters as molluscs, from the softness of their bodies, and therefore related to the oyster as the species to the genus, are sometimes found on the British shores.

“Most probably,” says he, “mere hunger first put men on that trial. Thus necessity has often been the purveyor to provide diet for delicacy itself; famine maketh men to find out those things which afterwards prove not only wholesome, but delicious;” and he concludes with the remark already mentioned, “Oysters are the only meat that men eat alive, and yet account it no cruelty.”

The speculations of a human stomach, in reference to some of its adventures, would doubtless be amusing, and the “Memoirs of a Stomach” will cast some light on the present subject.

“The day was over, the bell was sounded for ‘all in,’ and prayers were called, when, during the confusion of the boys rushing to their places, I found myself carried, as fast as legs could carry me, far beyond the precincts of the school grounds, so I felt certain that an ordeal of some sort was in store. Instead of finding myself as usual in a pastry-cook’s shop, a certain marine odour of stale fish puzzled me extremely; and I waited the elucidation of the mystery with such feelings as only a stomach experiences when he is all uncertain as to what is going on and what is coming in, and when he is placed at the mercy of a hungry and unscrupulous schoolboy.

“I was not long held in suspense, and never shall I forget my sensations. Down there came, flopping—no other word is descriptive—into my astonished inside, a small mucilaginous mass of a saltish flavour, almost fluttering with life (good powers! I thought, it has not had time to settle its affairs), accompanied by a fluid of extreme acidity, and by particles of black pepper, hot and pungent. I really was never so completely astounded in my life. Over and over I turned the wonderful compound, but could make nothing at all of the shapeless little monster.

Before I could give vent to a burst of invective, which I felt rising within me, another, and yet another, came unceremoniously slipping down, and then a torrent of a sort of licorish fluid, called porter, came gurgling and frothing after. At this a horrible suspicion flashed across me. For a moment the dreadful question rose in my mind, whether these peculiar substances, salt and flabby, which had so excited my awe and abhorrence, were the eyes of some of the poor brewers employed in the well-known firm of Nux, Vomica, and Co. This fearful idea seemed in a manner to be corroborated by the brackish taste I before alluded to, and which I naturally attributed to the flavour of the poor fellows' tears. The powder, it is true, cast a doubt as to the correctness of my surmises; but with exquisite imagination I looked upon *this* as some of that dust blown back into the faces of the men, which their master had endeavoured to throw into the eyes of the public when they playfully affirmed that their beer is genuine. Another cataract of black liquor, however, distracted my attention; and when the money chinked upon the counter, the name of this extraordinary little stranger (which was *not* welcome) was pronounced for the first time in my hearing, and the word *Oyster* was indelibly impressed upon my memory for evermore.

“Since that time I have had occasion to receive these creatures with extreme courtesy under all forms and circumstances, scoloped, stewed, buttered, devilled, with beards and without beards; but to the young ingenuous stomach like myself at this moment, the raw oyster, with adjuncts of strong vinegar and black pepper, and washed down with a semi-opaque fluid, will ever present features for recollection to linger over, and offers another proof of

how slight is the partition which separates the sublime from the ridiculous."

The species of oysters usually eaten are the common oyster (*Ostrea edulis*, Linnæus), of our own coasts and the opposite shore, and the horsefoot oyster (*O. hippopus*, Linnæus). On the Mediterranean coast are the rose-coloured oyster (*O. rosacea*, Favanne), and the milky oyster (*O. lacteola*, Moquin-Tandon), besides the small and little-known crested oyster (*O. cristata*, Born), and the folded oyster (*O. plicata*, Chemnitz). On the Corsican coast is the oyster called foliate (*O. lamellosa*, Brocchi).

Oysters undoubtedly are very nourishing. When the spirits are depressed, and disagreeable feelings pervade both body and mind, in consequence of impaired digestion, let the persons so afflicted eat a few oysters, and cheerfulness soon returns. They are enabled once more to see through the gloom which seemed to envelop the system in a living shroud; the physical powers are renewed, and life once more seems sweet to the man who but a short time before wished life was at an end. Whatever modern physicians may say—and there are few who condemn the oyster—there is little doubt that in olden times the doctors then existing recommended oyster eating; and not only that, but the external application of the bivalve to sores and bruises, as I have elsewhere mentioned.

It has been demonstrated as a gastronomic truth, that there is no feast worthy of a connoisseur where oysters do not come to the front. It is their office to open the way, by that gentle excitement which prepares the stomach for its proper function, digestion; in a word, the oyster is the key of that paradise called appetite. "There is no alimentary substance, not even excepting bread, which does

not produce indigestion under given circumstances," says Reveille-Parise, "but oysters never." This is an homage which is due to them: "We may eat them to-day, to-morrow, eat them always, and in profusion, without fear of indigestion." Dr. Gastaldi could swallow, we are assured, his forty dozen with impunity—quite a bank must he have eaten! He was unfortunately struck with apoplexy at table before a *pâté de foie gras*.

Montaigne quaintly says, to be subject to colic, or deny oneself oysters, presents two evils to choose from, since one must choose between the two, and hazard something for his pleasure.

The oyster may be said to be the palm and glory of the table. It is considered the very perfection of digestive aliment. From Stockholm to Naples, from London to St. Petersburg, it is always in request. At St. Petersburg they cost a paper rouble (nearly one shilling), and at Stockholm fivepence each. For the last year or two the English oyster eater has had to pay from two shillings to half-a-crown a dozen for choice natives. (1863).

The real secret of the great digestibility of the oyster lies in the fact that, although its substance is most nutritive, yet it contains a very small quantity of azotised matter—or matter containing nitrogen—of which the fleshy parts of the body are composed. It also explains the immense consumption of them attributed to the Emperor Vitellius. Without this being so Vitellius, all emperor and master of the world as he was, never could have absorbed twelve hundred oysters by way of whetting his appetite.

The gourmets were long of opinion that the quadrangular-shaped muscle or cushion in the oyster was the most savoury and exciting part. Certain distinguished amateur performers adopted and proclaimed the principle of divid-

ing transversely the body of the mollusc, and eating the cushion only. Natural history explains this gastronomical discovery. It recognises the fact that the bile secreted by the liver is contained in this substance, that it accelerates while it exhausts the qualitative surface of the tongue and palate, aiding also the functions of the stomach. (*d*)

The chemical composition of molluscos animals generally, as snails, &c., includes compounds of modified albumen and chondrin.

An analysis of oysters shows that they contain, in 100 parts, namely, of water 80.11; of dry organic matter (albumen and chondrin), 18.69; and of saline matter 1.2. In the saline residue, besides chloride of sodium (common salt), traces of iodide of sodium are found. (Brande and Taylor's "Chemistry.")

Another authority gives the following:—"A chemical analysis of the oyster reveals the fact that the creature contains a considerable quantity of phosphate of iron and lime, a large portion of osmazome, and an amount of gluten and isinglass. There is also in it a good quantity of salt of the same quality as that contained in sea water. The liquor found in the shell when the oyster is opened may be called the life blood of the animal, for without this fluid it cannot exist. This liquor, when examined by the chemist, is found to contain carbonate of potash, sulphate of lime, sulphate of magnesia, a small quantity of chloride of sodium, a little osmazome, and other organic matters."

A learned naturalist, dwelling on the sea-shore, possessed himself one day of a dozen oysters. He wished to study their organisation; he turned them, and turned them again, examined their several parts inside and out.

(*d*) "The Ocean World," pp. 380-2.

He made drawings of and described them, and having satisfied himself that he had exhausted his scientific skill in observing them, he swallowed them; the interesting bivalves had lost nothing of their excellence, and the examination did not prejudice their flavour. (*e*)

Returning once more to the very salutary effects of an oyster diet, it has been proved beyond doubt or dispute that the bivalve exercises a remarkable influence in all cases where the nervous organs are affected—more so than any other kind of food that can be taken into the system.

Physicians recommend the judicious consumption of oysters to all persons suffering from weak digestion, and one of the faculty (Dr. Pasquier) has asserted that they may be given with great advantage to persons of intemperate habits, who, by inefficacious medical treatment, have fallen into debility and lowness of spirits. Gouty patients are also recommended by the same adviser to feed moderately upon oysters.

A very old man was suffering from influenza, which, in consequence of his age, threatened fatal results, but by the judicious use of oysters he was entirely cured; and Boerhaave, the renowned Dutch physician, has recorded that he knew a big, strong, tall man, who had fallen into a decline, and who, after all remedies had proved entirely useless, was rapidly restored to health by a diet of oysters, and lived to the age of ninety-three years.

Another French physician (Dr. Leroy) was in the habit of taking two dozen of these delicious fish every morning before breakfast, and when he had finished them he would exultingly exhibit the empty shells to his friends,

exclaiming with a smile, "There you may behold the fountain of my youthful strength."

Dr. Lenac considered them the most nourishing food in existence, and another writer (Percy) relates having seen a large number of wounded persons, exhausted by the loss of blood and bad treatment, who were entirely kept up by eating oysters.

The above proves that oysters make blood, or increase the quantity of that fluid circulating through the veins, without heating the system, or bringing on any of those feverish symptoms which other forms of diet and medicine are apt to produce.

"When in Prussia," writes the author of "The Oyster," "I once asked a person who did a large retail business in oysters what class of persons he found to be his best customers, and what was the number of oysters daily consumed by each individual?"

"The morning scarcely begins to dawn," he replied, "ere ladies and gentlemen, boys and girls, and servants, both male and female, make their appearance, not only from my immediate neighbourhood, but also from the most remote parts of the city, when, on an average, every one buys from half a dozen up to a dozen, in addition to their purchases for the several families, and in accordance with their requirements."

And those who do likewise in Great Britain and Ireland will soon find out the benefit of this nutritive food taken thus early on an empty stomach. "I once heard of an individual," continues the same accomplished writer, in his scholarly and edifying brochure, "who made a bet that he would eat twelve dozen oysters, washed down by twelve glasses of champagne, while the cathedral clock of the city which he inhabited was striking twelve. He won his

bet by placing a dozen fresh oysters in twelve wine glasses, and having swallowed the oysters, he washed down each dozen with a glass of champagne. I should not have mentioned this disgusting feat, but to add that he felt no evil effects from the oysters, proving incontestably the digestive and sanitary properties of this mollusc."

There is a similar tale, showing equally the effects of oysters on the human digestion. Four persons met one Saturday night, at an hotel, and made the following bet : each person was to call for whatever he might fancy, either to eat or to drink, and he who kept longest awake was to have no share in the liquidation of the bill. This settled, one of the party made a private arrangement with one of the waiters, promising him a reward if, in case of his evincing the slightest drowsiness, he would bring him forthwith twenty-five oysters. This was accordingly done ; but the waiters had to be constantly relieved until 11 o'clock on the following Monday morning, when, observing his three companions quietly asleep, our oyster-eating friend called for the landlord, and declared himself triumphantly the winner, attributing his good fortune entirely to the oysters.

Wise people eat oysters and eschew pills ; take lumps of delight, instead of lumps of nausea ; uphold the Whitstables, Colchesters, and Miltons, and have nothing to do with the Holloway's, Beecham's, and Cockle's. When suffering from almost incurable indigestion, by taking oysters daily they very soon find the most agreeable effects on the human kitchen and laboratory ; its functions become regular, without the use of strong medicines. Depression of spirits and other disagreeable feelings consequent on impaired digestion soon cease to affect them ; headaches disappear, and the heretofore dyspeptic, sour,

unhappy tempered man, becomes a pleasant and joyous companion, full of life himself, and inspiring to those around him.

In endeavouring to emphasize this fact, and the better to impart to the reader a more desirable appreciation of my subject, I think I cannot do better than here relate the story of

THE MISER AND THE OYSTERS.

Many years ago Medford, in the United States, had a far-famed miser as one of its lions. He was a man of ability and rectitude, but a monomaniac where money was concerned. At one time his yearly income was 30,000 dollars, and of this he spent as little as would keep soul and body together. Medford was a sort of suburb of Boston, and he lived there to save the city taxes. The two places were connected by a bridge, for crossing which a cent toll was levied on pedestrians. The miser had to go to and from his business in Boston, and his favourite device was to get into some cart with a complaisant driver, and so escape the charge for foot passengers.

One day, in an early and a genial season, he was returning home, hungry and faint. Dinner in town was expensive, and he usually adjourned the function until he reached his lodgings, where the most frugal fare was in waiting.

This time he had been delayed, and was feeling and looking extremely ill. No handy cart came by. It was clear that he must pay toll and walk. But his limbs seemed to fail him, and his resolution broke down. An oyster stall was just outside the toll bar, and he was sorely tempted to buy. Strength he must have for his journey.

The man who hesitates is lost, and the oyster vendor thought that he had a customer, and that a marvel was happening, when the shabby figure stopped and the miser was obviously debating pros and cons.

"How do you sell your oysters?" The voice was a weak quaver.

"Six cents a dozen for the small and twelve for the large," was the answer.

The poor wretch looked long and wistfully. It was a wrench to part with cash.

"Won't you let me have a dozen of the large for ten cents?"

"No," snapped the salesman.

It was hard lines, but at least the toll might be saved.

"Suppose I have half a dozen of each: will you let me have them for eight cents?"

"I've told you my price; if you won't pay that you shan't have any."

As the words were spoken, a passer-by, to whom the would-be bargain driver was unknown, and who was struck by his wan and threadbare appearance, threw some coins on the stall.

"There, buy a dozen!" And he hurried on.

With instinctive eagerness the miser put out his talon-like fingers and gathered in the gift. But his purpose was unchanged.

"Shall I have the half dozen of each for eight cents?"

"No, you Jew!" cried the oyster vendor.

"Then I'll—keep the money."

And the victim of avarice grudgingly disbursed his gate fee, and pushed on over the bridge. After all, he had often denied hunger and weariness before.

But the story got into the newspapers on this occasion, for his vigour of body was not equal to his doggedness of will. He fainted on the road a considerable distance out of Medford, and was found and carried in by a good Samaritan, who gossiped subsequently about the rescue.

"I have lived a good deal abroad," says the author above mentioned, "and am induced to ascribe much of the vivacity of the French to their intense love of oysters. During a long residence in France, I never met with a Frenchman or Frenchwoman who said nay to a dish of good fresh oysters; in fact, they have a craving for the 'breedy creatures,' which in many persons almost amounts to gluttony, and then, and then only, does this craving lead to mischief."

Physicians of old recommended the oyster as a general remedy, and employed it on all occasions with success. It has been proved beyond dispute that it possesses a remarkable vivifying influence in all cases where the nervous organs are affected, more than any other food. Oysters taken before mid-day, with a glass of wine, produce a most salutary effect. The nerves and muscles regain their strength, and the body its mental and physical powers, bringing cheerfulness and energy to compete with the duties of the day. If not a cure, at all events an oyster diet, under medical supervision, brings unquestionable relief to those who are suffering from pulmonary complaints, indigestion, or nervous affections.

Even in the influenza epidemic which, raging in continental cities, visited us at the latter end of last year and the beginning of the present one, oysters were recommended as one of the numerous remedies suggested and acted upon to check the trying disease, in confirmation of

which I quote the following comment from the *London Daily Telegraph*, Jan. 1, 1890 :—" Can this country be congratulated upon having escaped the influenza epidemic which is now raging in continental cities ? The facts are difficult to ascertain, for, whilst it is circumstantially affirmed that at least three deaths have already occurred in the metropolis, such fatalities are officially unknown to directors of public institutions and to leading physicians who are in the best position to hear of an outbreak of the disease. It is stated that Kensington, Belgravia, and Dulwich, are the districts chiefly affected, but there is reason to believe that exaggerated reports of infection have originated in panic, for there is a great dread of the appearance of the trying complaint in London. Unfortunately, it cannot be denied that influenza cases of an epidemic type have developed in the West-end and suburbs. One eminent physician of large practice has treated no less than seventeen patients, but careful investigation shows that all these, directly or indirectly, either contracted the illness in Paris themselves, or from persons who have recently returned to England suffering from influenza. The symptoms in these instances were identical, the aching of the limbs being marked, with a high temperature and exceeding dryness of the throat. The great danger is caused by the keenness of devitalisation which is induced, making the victim liable to consequent pneumonia. All sorts of remedies are recommended, including camphor (which is a capital antiseptic), and quinine ; but a medical man of high authority declares that the best things to strengthen the system which has fallen below ' par ' against attack are oysters and champagne. He further adds, by way of reassurance, that we have had no epidemic of influenza here since 1848, and it is very well known that frosty

weather will cause a subsidence in the activity of the disease germ."

But to ladies particularly do I recommend oysters, as the best of all light meals between breakfast and dinner. At the period of a lady's married life when nausea is prevalent, a few fresh oysters, taken raw in their own liquor, with no addition but a little pepper, and a fairy slice of French roll or other light bread, a fresh lemon squeezed over each, stops the feeling of sickness, and keeps up the stamina unimpaired. During the time, too, when a young child most requires maternal care and attention, the mother's diet of oysters will impart strength to the infant, and tend much to alleviate the pains of its first teething.

There are many persons who, looking at an oyster calmly reposing in its shell, have a repugnance to the eating thereof, and it may be difficult to overcome the dislike. However, as a proof that oysters in general are nice to the taste, let me mention that children under two years of age eat them with great appetite; and it is only after having discontinued eating any for some time that they take a dislike to them.

But that dislike is generally very easily overcome. If any reader of this book experiences a difficulty in persuading a friend to take his or her first oyster, let the following method of procedure be employed:—Take a French roll (or a piece of milk-bread), thinly buttered, and put on it the oyster deprived of its beard, then squeeze a few drops of lemon juice upon it, and present it to the person, who, as a rule, will swallow it, and make some remark to the effect that the taste of the oyster is not so disagreeable as it looks, and then, probably, will demand a second and a third.

Of course it is always possible to have too much of a good thing, and so one may swallow too many oysters, or shell-fish of other kinds. When this is the case, and unpleasant sensations are the result, the inconvenience may be entirely removed by drinking half a pint of hot milk; in fact, people of delicate organization ought always to drink hot milk after oysters, instead of the brown stout that more robust souls delight in.

When eaten for health, an oyster is best swallowed in its own liquor the moment the shell is opened; or, if too cold for the stomach, a sprinkling of pepper will remedy the evil. Vinegar counteracts the effect of the oyster enriching the blood; so, when the oyster is eaten medicinally, it must be excluded.

Strange as it is, it is still true that persons are to be found who pride themselves on the number of oysters they can eat. "If the reader, contemplating an oyster lying on its native bank, or subsequently on its bed, calmly imbibing nourishment as its only occupation, has thought that there is an oyster-life of humanity, the allegation may for a moment be entertained, from what we know of the *gourmands* of the past and present. Not that we should judge without intelligent discrimination. It is easy to heap people together, as was done in a huge machine at the time of the French Revolution, that they might be plunged together into the Seine, to save the troublesome formalities of a trial; but we should guard, even on the smallest scale, against any such outrage of truth and righteousness."

It must therefore be admitted, that a temperate use of the bounties of Providence coincides entirely with the purposes and precepts of Him who hath "given us all things richly to enjoy." We may not only eat to live, but we may eat that which specially ministers to the gratifica-

tion of the palate, provided that in so doing we violate no personal nor relative obligation. It requires a well-regulated conscience to describe the precise line anyone should observe ; but if the mere epicure has advanced to one extreme, assuredly the other is occupied by such persons as the monks of La Trappe, who confound self-mortification with the highest virtue.

Nor should it be overlooked that a broad line of demarcation exists between the Romans named Apicius and Lucullus, though it is often allowed to be effaced. One of them lived under the reign of Tiberius, and became notorious for discovering new sources of culinary enjoyment, arranging more appetising combinations of those formerly known, and ransacking every kingdom of nature and every quarter of the globe then known, for fresh objects to stimulate and gratify his palate. This was the man who, after squandering upwards of £800,000 on the indulgence of his all-engrossing passion, hanged himself because there remained only the scanty pittance of £80,000, to the mere subsistence on which he thought, in his infatuation, death was preferable. Sundry cakes, called *apicia*, long kept alive his memory among the Romans. Apion, the grammarian, compiled a work on his luxuries, and his name passed into a proverb associated with the pleasures of the table.

The life of each Apicius was, however, that of an oyster—he lived to eat. But Lucullus, though his feasts were celebrated on a scale of extraordinary magnificence, cultivated literature from his earliest years: he accumulated a valuable library, which he opened to the free use of the public ; he patronised men of letters ; he associated with the Greek philosophers and literati, who in his day swarmed in Rome ; he was remarkable for his equity and

benevolence; and while he maintained in the exercise of these qualities the discipline of the troops he ably commanded, he greatly surpassed his contemporaries in his treatment of the vanquished.

In no instance, then, should we confound a large expenditure with extravagance, or the occasional with the habitual. Even if our judgment be sound—and the proof is always wanting where this is hastily assumed—unless the minutest details are all arranged and surveyed, any decision would only indicate our folly, and may justly bring on us shame. When a balance can weigh the ten-thousandth part of a grain, what a trifle will cause a preponderance!

Still, it must be contended that a mere oyster-life is of more frequent occurrence than might at once be admitted. Of one person it is said: “He has learned the science of good eating by practising it, and he often orders down to Salisbury from London a couple of quarts of turtle and a haunch of venison, for his own eating, and sits down to dinner by himself; scorning (like Sir Hercules)” —we suppose Sir Hercules Langrish—“all assistance but that of a bottle of Madeira and two bottles of old port.” (*Quarterly Review*). We have ourselves known parallel instances of as enormous, if not as solitary gluttony, and there are many others that make to it an approach that is lamentable and degrading. For

“What is man,
If his chief good, and market of his time,
Be but to sleep and feed? A beast—no more.”

Even the beast is disgraced, however unintentionally, by the poet's comparison. The quadruped obeys its appetite, but without excess in a morsel or a drop. The bird is equally a symbol of temperance. Even the oyster closes

its shell when a sufficiency of food has been brought to it by the waters. Lucian ridiculed the philosophers who, according to his satire, spent their lives in inquiring into the souls of oysters. But the mere gourmand, whether he be so notoriously or secretly, overlooks his soul, and treats his body as if that were *the man*. And can mind—the soul—be disregarded with impunity ?

“Sure He that made us with such large discourse,
Looking before and after, gave us not
That capability and godlike reason
To rust in us unused.”

“All things,” says Coleridge, “strive to ascend, and ascend in their striving. And shall man alone stoop ? Shall his pursuits and desires, the reflections of his inward life, be like the reflected image of a tree on the edge of a pool, that grows downwards and seeks a mock heaven in the unstable element beneath it, in neighbourhood with the slimy water-weeds and oozy bottom grass that are yet better than itself, and more noble, in as far as substances that appear as shadows are preferable to shadows mistaken for substances.” “No !” Reason exclaims ; “it must not be.”

To assume that it may is even to degrade human existence below the level—humble as it is—of an oyster’s life. The oyster—scorn it who will—yes, the oyster, whether it perishes on its native beach, or lives on the bed to which it is transferred to gratify the human palate—perfectly answers the purpose of its being. In no respect does it fail of the end contemplated by Him who called it into life, and who “openeth his hand, and satisfieth the desire of every living thing.” Let, then, each one ponder the question : “Do I answer the purpose for which I was

created and am sustained in being ?” And let the reply be the guide of our future steps. (*f*)

But the oyster was also formerly used externally as a remedy, no less than taken internally for its medicinal properties. Its very abundance is a clear proof of the bounty and goodness of Providence, furnishing us, at one and the same time, with such delicious food, and so universal a remedy for the ills which man is heir to.

Ambroise Paré, physician to Charles IX., and the only Protestant whom the King sought to save from the terrible massacre of St. Bartholomew, by shutting him up in his own closet, recommends oysters smashed in their shells as an excellent poultice. “This animal, so used,” says he, “diminishes pain, and removes all heat and inflammation in a remarkable manner.” As the opinion of one of whom the King himself declared that “a man so useful to all the world ought not to perish like a dog,” it may be admitted to a place in my book, more particularly as it is borne out by Paul Egona, who also recommends oysters being smashed and saturated with their own liquor as the very best of all poultices for sores or boils.

Let me, in closing this chapter, add a few words on the digestibility of the oyster from a medical point of view.

In a Lecture delivered to the Training School for Nurses, at the Episcopal Hospital, Philadelphia, Dr. Frederick P. Henry (*g*) said:— . . . “There is, at least, one article of food that is rendered less digestible by cooking, and that is the oyster. You may remember that, in my last lecture, in speaking of the destination of starch, I

(*f*) “Adventures of an Oyster.”

(*g*) Physician to the Episcopal, Philadelphia, and Jefferson College Hospitals.

told you that after being rendered soluble by conversion into dextrin and maltose, it was absorbed and carried to the liver by the portal veins, when it was reconverted into an insoluble animal starch called glycogen. The soft fawn-coloured mass which forms the bulk of the oyster is its liver, which is almost entirely composed of glycogen, but kept from actual contact with it during life, is its appropriate digestive ferment—the hepatic diastase. When the oyster is crushed by mastication, the glycogen and diastase are brought in contact, and digestion takes place immediately, without any aid from the gastric secretions of the eater. In cooking the oyster, this hepatic diastase, like all digestive ferments, is destroyed by heat, and digestion of the bivalve must take place in the ordinary way.” (*h*)

In connection with the above I append a Guide to Digestion. I have extended the list as far as is known, and based its accuracy on that of the highest authorities in the medical profession. Strictly speaking, I need only have confined myself to the oyster alone; but the remaining edible members of the shell-fish genus appealed so pathetically for equality of honour with the oyster in the useful record of their digestive qualifications, that I could not withstand the appeal. But, no sooner granted, the *Fishes* likewise aspired to and sought the same honours. “Is it not natural,” they seemed to me in thought to argue, “that the reader, knowing and having learned so much about the oyster and his kin and kind, would also wish to learn how we too serve man in the digestive regions of his wonderful economy?” Could I gainsay this plausible argument? No! Therefore have I given the list in full, for the reader’s information.

(*h*) “Some of the principles governing the preparation of food for the sick.”—*Dietetic Gazette*.

GUIDE TO DIGESTION.

The time required for the digestion of the various articles of food in the stomach.

					Average time of digestion.	
					Hours.	Minutes.
Raw Oysters	..	..	..	..	2	15
Stewed Oysters	..	..	..	..	2	35
Mussels	..	..	..	..	3	30
Cockles	..	..	..	..	3	45
Periwinkles	..	..	..	..	3	30
Whelks	..	..	..	..	4	30
Crabs	..	..	..	..	4	0
Lobsters	..	..	..	..	4	0
Anchovies	..	..	..	..	4	0
Brill	..	..	..	..	3	20
Cod Fish	..	..	..	..	3	30
Conger Eel	..	..	..	..	4	35
Dabs	..	..	..	..	3	10
Dace	..	..	..	..	2	45
Eels <i>fried</i>	..	..	..	..	3	10
„ <i>stewed</i>	..	..	..	..	2	45
Flounders	..	..	..	..	3	35
Gurnet	..	..	..	..	3	0
Haddocks	..	..	..	..	4	0
Hake	..	..	..	..	4	0
Herrings	..	..	..	..	3	5
Ling	..	..	..	..	3	30
Mackerel	..	..	..	..	4	0
Mullet	..	..	..	..	2	25
Plaice	..	..	..	..	3	0
Prawns	..	..	..	..	4	0
Sardines	..	..	..	..	3	10
Salmon	..	..	..	..	4	0
Shrimps	..	..	..	..	3	45
Skate	..	..	..	..	4	0
Soles	..	..	..	..	2	5

Sprats	..	..	..	..	3	0
Turbot	..	..	..	..	2	20
Whitebait..	..	..	..	..	3	0
Whiting	..	..	..	..	3	0

At the moment in which natural death ensues, all animal matter begins to show its chemical affinities by separating again into the elements of which it consists; and as at such times it is always more or less of a poisonous nature, it is well to study the method by which it may be known whether an oyster be living or dead when its shell is opened. This can be seen at a glance. If the muscle appears sunk, it is a proof that the animal was living; but if it appears higher and above the oyster, it was dead before it was opened, and the animal is, consequently, unwholesome and unfit for food.

Having been frequently asked a variety of questions concerning the taste of oysters, the best kinds to buy, how to eat, what to avoid in the eating thereof, how many one may eat, &c., &c., I deemed it my duty (in addition to the valuable opinions scattered throughout these pages) to answer these questions according to my own experience, which is a wide one; yet, strong as I felt the duty to be, when I began writing this page, I had not sufficient confidence to record either my epicurean experience, or to place my opinions concerning the illustrious bivalve in fellowship with those of the high authorities alluded to. So then, in order not to shirk my duty, I adopted a medical method of procedure to overcome my uncertainty; that is, I held a consultation, not with a medical practitioner, but—with an oyster merchant. To be more explicit, I resolved to write to one of the largest oyster firms in London, and, stating my object, requested the manager to send me ten different varieties of oysters—those most in

demand—for the purpose of comparing one with another. My request was most kindly complied with, and attended to with courteous promptitude, together with very serviceable hints relating to the oysters in question; for all which I take this opportunity of acknowledging the said company's favours, and thanking them for their kind assistance.

Well, when the oysters arrived, my wife and I, and several friends were prepared to receive them with all the hilarity befitting the occasion. We examined them critically, discoursing the while most learnedly upon their merits, their history, their anatomy, &c., &c., and, for the reader's benefit agreed upon the following opinions with regard to the average size, shape, growth, external and internal description, if easy or hard to open, and lastly, but not least—the flavour. These and other particulars I will endeavour to convey to the reader's comprehension in order that the whole may form a guide to his selection, and an answer to the question—What to buy?

Before giving these interesting items of information I wish to draw the reader's attention to a very important one sent me by the above-named Company.

“It is generally known that when a foreign oyster is relaid in English waters, a very great improvement is plainly discernible in its appearance after a four months' sojourn, but comparatively few are aware that this improvement is gained at a loss not only of its native shape, but likewise (and especially so) of its taste.” How this happens I know not. But here is the List giving all necessary details to aid the reader's taste and selection.

1. ROYAL NATIVES.—Born and bred in Brittany (France); fattened in English waters. Average size; $2\frac{1}{2}$ x $2\frac{1}{2}$ inches. Shape; crescentic,—nice looking. Gen-

eral description.—Exterior; aristocratic-looking, flat, light shell, convex and delicately ridged from beak to margin. Interior; white adductor muscle mark. Easy to open. Flavour; very sweet, delicate and delicious. Evidently the same as Whitstable Natives.

2. DUTCH NATIVES.—Born, bred and fattened in Holland, and imported from Holland direct to London. Average size; $2\frac{3}{4}$ inches broad, 3 inches long. Shape; nearly crescentic. General description.—Exterior; rather heavier-looking than the last variety; top shell nearly flat; convex shell has ridges radiating from hinge. Interior; white adductor muscle mark, fish rather yellowish. Easy to open. Flavour; not very decided, or, not quite so delicate as the last variety; certainly sweet and appetizing.

3. VICTORIAS.—Born and bred at Le Chateau; fattened in England. Average size; $3\frac{1}{8}$ inches broad; $3\frac{1}{8}$ inches long. Shape, crescentic. General description.—Exterior; an aristocratic, compact-looking oyster; flat shell, nearly smooth; convex shell delicately furrowed but less marked than the Royal Native. Interior; white adductor muscle mark; plump fish; shell well filled. Easy to open. Flavour: sharply-fresh, delicate, melts in the mouth, unequalled. Is all what an oyster should be, (*i.e.*) sweet, sharp, luscious, appetizing, and, in my opinion carries the palm. Le Chateau is situated in the Isle of Oleron, on the Western Coast of France.

4. OPORTOS.—Imported from America and fattened in England. They are really American oysters. Average size; $3\frac{5}{8}$ inches long, $2\frac{3}{8}$ inches broad. Another,— $4\frac{3}{4}$ inches long, 3 inches broad. Shape; beak-shaped, curved on the flat. General description.—Exterior: rather rough

looking oyster, coarsely corrugated ; deep serrated ridge running from beak to the opposite side on convex shell ; upper shell slightly convex. Interior ; burnt sienna adductor muscle mark. Hard to open. Flavour ; good, but not equal to any of the preceding ; not so rich.

5. DIRECT OPORTOS.—Are not the same as the Tagus Portuguese. Born and bred in France ; imported direct ; not laid in English beds previous to sale. Average size ; 5 inches long, 2 inches broad ; grow to much larger size. Shape ; long, curved and undulated, rugged, coarse and very unequivalve. General description.—Exterior ; very coarse and rough-looking, brittle, elongated ; no depression on flat shell ; convex shell unusually depressed ; much resembles the Tagus oyster. Interior ; bluish-purple adductor muscle mark ; oyster very large ; great quantity of liquid ; long black beard. Not very hard to open. Flavour ; rich, slightly metallic. Contains more Iodine and Bromine than any other variety ; their grandparents originally came from the Tagus, but being cultivated in France, the composition of both shell and flavour become modified.

6. RELAID PORTUGUESE.—Born and bred on French Coast ; fattened in England. Average size ; 4 inches long, 4 inches broad ; grow to much larger size. Shape ; circular, thick and coarse-looking. General description.—Exterior ; coarse, thick circular ridges following the shape of the shell ; smooth top shell, lower shell slightly convex ; very limey appearance. Interior ; white adductor muscle mark ; small fish for size of shell ; some chalky deposit filling up space towards the lip. Hard to open. Flavour ; no very decided taste, but agreeable. Chemical qualities and descent, same as the Direct Oportos.

7. DIRECT AMERICAN.—Brought direct from America to London; not laid in English beds prior to sale. Average size; $3\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches broad. Shape; curved on the flat, beak-shaped. General description.—Exterior; coarsely corrugated on convex shell, with the corrugations radiating from the lip; upper shell nearly flat. Interior; blue-brown adductor muscle mark. Very hard to open. Flavour; tasty, but not rich or delicate. Other remarks.—Blue Points—so called on account of the blue spot left on the shell after detaching the oyster; the spot remains the same whether the oyster is transplanted or not. “Blue Points” and “East Rivers” are very similar, coming originally from the same place—Chesapeake Bay. The Blue Point is cultivated for market purposes at Long Island, and the “East River” in the East River. There are direct East Rivers and East Rivers planted in England often called relaid East Rivers.

8. CALLIES.—North Sea; deep sea oysters; fattened in England. Average size: 3 inches long, $2\frac{1}{2}$ broad. Shape: very irregular; curved in all directions; attached to broken piece of rock. General description.—Exterior: very rough and uncouth looking, with piece of rock attached; undulated in every direction with numerous excrescences all over the surface; resembles a rough stone more than an oyster; in reality, a thin hard shell. Interior: Blue adductor muscle mark; Fish well fills the shell; corrugation marks well seen inside. Easy to open. Flavour; sweet, luscious; exceedingly good. Quite different to the Callais.

9.—FRANCO-DUTCH.—Born and bred at Arcachon in France; fattened in Holland and brought direct to London. Average size; $2\frac{1}{2}$ inches long; $2\frac{1}{4}$ inches broad. Shape;

nearly circular, General description.—Exterior; thin, delicate-looking shell, similar in shape and appearance to a native; top shell flat; lower one corrugated with slight serrated impression. Interior; Bluish adductor muscle mark. Shell well filled. Very easy to open. Flavour; rather metallic, but agreeable, though not to be compared with a native.

10. CALLAIS.—The sample sent me were born and bred at Callais, but fattened in Sussex beds. Average size; $4\frac{3}{4}$ inches by 5 inches. Shape; nearly circular. General description.—Exterior; delicately and thin shelled; aristocratic-looking. Interior; white adductor muscle mark, well filled, light mantle. Hard to open. Flavour; fresh, sharp, delicate; about equal to a Dutch native, or Callies variety. The largest are sold in the French markets. French fishermen are only allowed by Government to dredge for them occasionally.

With regard to the question—"How to eat an Oyster?" that has already been very ably answered by trustworthy authorities, in the pages of this chapter, but what little my own experience may enable me to add is quite at the reader's service. Permit me, however, to preface my brief tribute of a fact founded on practical experiment, by warning the querist, and *all* my non-corresponding readers that when they eat an oyster raw (which is ever the most satisfactory, the most wise and most constitutionally-beneficial way of eating it) to *avoid* the gravely-erratic, but popular adjuncts of pepper, vinegar, or lemon juice. This is a repetition! I know it. But it alludes to a gustatory custom universally in vogue, and

"More honoured in the *observance* than the *breach*," cannot be too frequently impressed upon the would-be Oyster-eater's memory.

Once more, I would advise you to open your own oysters, or learn to do so as quickly as possible, being careful at all times to save the precious liquor (the life invigorating qualities of which have been already described); should you, however, be, what I may term, so constitutionally-unfortunate as to find the liquor distasteful to you, use it for the purpose of washing your hands. After repeated experiments, I find that the skin of the hands when washed in oyster liquor, become soft and white. The hands, subject to this immersion, experience an effect very similar to that of the waters of Schlangenbad—the famous German watering resort for invalids. But, after all, I would counsel you rather to drink the liquor than misuse it thus, and when you open an oyster, do not forget to do so with the convex shell downwards, so as to retain as much of the fluid as possible, and *masticate* the bivalve, not *swallow* it, to get the true flavour.

“When to eat Oysters?” Oyster Suppers are common enough! We never hear of an Oyster Breakfast, Luncheon, or Dinner, and the preference for supper and supper-time is because they are so easily digestible, and, of course, do not lie heavy on the stomach. But, for all that, it is by no means unusual to partake of a few to act as a first course either at luncheon or dinner, but in each case they are eaten solely with a view to invigorate the appetite for what may follow. With regard to my own liking I prefer them when *in season*; (from the 5th of August till the 14th of June) a few of the luscious bivalves never come amiss.

It is a remarkable fact that a daily meal of them after a lowering illness, very considerably reduces the length of convalescence.

Travelling is deleterious to oysters; their taste becomes insipid; they seem to sicken, and lose their plumpness, which ills increase the more they are exposed, when opened. It were well, therefore, to remember that the sooner oysters are eaten after being dredged, the better.

It is also harmful to keep them too long packed in ice. So far as regards oysters in bulk, or shelled oysters, the following interesting paragraph from the "Detroit Free Press," Jan. 25th, 1890., will prove instructive. "A citizen thoroughly posted in regard to shell fish, says that shelled oysters and clams loose much of their natural flavour by being brought in direct contact with ice. Dealers in bivalves will sometimes put as much as fifty pounds of ice into a few gallons of oysters, weakening their natural juice to a great extent, and destroying their flavor, and at the same time greatly enhancing the profits of the trade. As well might ice be placed in milk to keep it fresh, or in ice cream, instead of outside of it. In most cases oysters treated in that way are little if any better than so many fresh water clams. It is just as easy to keep bulk oysters and clams fresh and sweet, by placing ice around the vessel containing them, as to place the ice in direct contact with them, although the profits would not be so great to the trade. In the latter case a great deal of what is sold as oyster or clam juice is really melted ice. Bulk oysters sprinkled with salt and kept in a cool place for a few hours will be much improved in flavor and increased in size." If this statement may be relied upon, it goes far to prove that a *like effect* (but, of course, in a lesser degree) must result to the *unshelled* oysters, from the ice in which our Oyster Merchants are accustomed to pack them. A probability which a reference to Mr. Hamilton's Letter, from the "Lancet" of this year, will serve to strengthen.

With respect to the quantity a person may eat, I can only say that it depends upon the taste—the disposition—and how long one has been without food. The various quantities which some historical personages have been able to eat will be found recorded in the 4th Chapter; but, as to how many a person may eat, perhaps the advice of an epicure will give a satisfactory reply.

“Does appetite e’er seem to fail?

Do dishes lose their savour?

Then try some oysters, natives, mind,

In *native* state, or else you’ll find

You’ve robbed them of their flavour!

How many eat? Well, say three score,

And, if you’re willing, three score more!”

There is no fixed rule with regard to the quantity of oysters a person may eat. The second mouthful is more tempting than the first—the third surpasses the second and so on and on.

“The appetite but grows by what it feeds on.”

But I will not go so far as our poetical adviser, I will say that if you were on a trawler and had your oysters fresh from the Dredge, with a bottle of wine, or good stout—of the Guinness, or Ratcliffe and Jeffrey’s brewing—and your brown bread and butter, *then* 25 would limit your claim to being called a Gourmand. I have never heard of any one making himself ill by eating too many.

“What to avoid?” This can be answered in a few words, namely, a *stale oyster*, which, like a stale egg, once tasted, will not be easily forgotten. Again, too much stimulant with the meat, will dilute the gastric juice and so retard digestion.

CHAPTER XVII.

OYSTER CULTURE IN ENGLAND.

SUCCESS OF THE OYSTER-FARMS ON THE COAST OF FRANCE—
CAPACITY OF DREDGERS—MR. FENNEL'S REPORT—HAYLING
ISLAND—ANNUAL CONSUMPTION OF OYSTERS IN LONDON—
PROPOSED OYSTER VESSELS—M. DELIDON ON "SPAT"—CHEAP
OYSTERS.

(*From the "Times," October 15th, 1867.*)

In the *Times* of September 6, 1866, was a notice of what had recently been doing on the south coast of England and the north coast of France, but more particularly referring to attempts just commenced on the former, in the establishment of Oyster Farms for the breeding, growth, and fattening of oysters for the market.

The oyster farms on the coast of France continue their work successfully and supply a vast number of oysters to the Paris and other markets; but their success is understood to have been more marked in the growth and fattening of purchased oysters laid down in their *parcs* than in the raising of spat from old fish. The same may be said of most of the oyster farms on the English coast, although there are exceptions here to which we shall presently refer.

In the establishment of any oyster farm, where the operations are mainly intended for the breeding of oysters

that are to be afterwards preserved for growth and fattened for the market on the same ground, there is necessarily a large outlay of capital made in the first instance, and three or four years must then elapse—presuming that a rise of spat has been obtained from the first batch of oysters laid down in the prepared beds—before any return can be obtained from this original expenditure. With this important fact ever present for the consideration of the oyster producer, it is not surprising that a far greater amount of attention has been paid by them to the growth and fattening of oysters purchased from coast dredgers, than to the raising of spat from old fish. The acknowledged result of this course has, however, been to denude natural breeding grounds on both coasts of fish, old and young, and it has only been the almost insurmountable difficulty met with for several years now in procuring oysters of any kind suitable for the fattening beds, that has turned the attention of people in the direction of breeding as well as fattening oysters for the table.

Mr. Lowe, one of the secretaries of the Acclimatization Society, has stated that, in answer to his inquiries concerning the French natural oyster beds, he was informed that the number of oysters dredged from the Cancale deep sea beds in 1863 was under four millions, while twelve years previously the take averaged sixty millions. He also refers to the well-known fact of the discovery of a bed of oysters lying off in the Channel between the two coasts, which was three miles in length. In a very short time the oyster dredgers cleared the bank, and destroyed all life for reproduction by their rapacity.

Mr. Ffennel, Inspector of Fisheries, reported a few years since that on one part of the Irish coast one bed of oysters gave employment to 2000 fishermen, but so reck-

lessly were the beds dredged for the unfortunate bivalves that the freight, which once reached £1000 per week in the season, had fallen down to £300 per annum.

The French were the first to appreciate the full weight of the suicidal policy pursued for the supply of oysters by this overdredging of the natural deep sea breeding grounds. MM. Coste and Kemmerer may be considered to have been the pioneers of the new state of things on the French coast, where the main supply of the future for the markets is looked for from the breeding beds established at St. Brieuc and other places.

Referring to what the French have done in this respect, Dr. Henry Lawson, the late editor of the *Popular Science Review*, says—"The most convincing evidence of all is that afforded by the Isle of Ré. Five years since the shores of this island were barren and uncultivated; now they give employment to 3,000 men, and the crop of oysters produced in 1861 was valued at £320,000 sterling." The oyster farms on the Isle of Ré are, however, much more valuable and productive now than at the time Dr. Lawson wrote of them.

The most successful instance of the rise of oyster spat and its preservation up to this time on the English coast for the present year has occurred on the same part of the coast as it did the previous summer—at Hayling Island, a few miles east of the Isle of Wight, where an enclosed area of water of eighteen acres, and of from five to six feet in depth, may be almost said to be crowded with young oysterlings. To show, however, clearly what has been done and is now doing with oysters at Hayling, we must leave the baby mollusks, and travel backwards for a short time. We may refer to the *Domesday Book*, and find there the Hayling and Emsworth oyster-beds referred to, and

marked with a certain annual value, those of Emsworth being valued at 6s. 8d.

Looking back through the haze of centuries, in fact, there is no apparent limit to be found to the time of the laying down of the oyster in the waters of the harbours now called "Langston," "Emsworth," and "Chichester." In making excavations for the formation of new beds a few weeks back at Hayling, through a morass that must have been a morass for ever, the remains of a skeleton were found which had been interred in the ancient manner, with the knees drawn up to the chin, and with the remnants of oyster and other shells with it. A few moments after exposure to the atmosphere the bones fell into indistinguishable form in dust. The natives of the island, so it has been said, aver this to have been the remains of the man who first tasted an oyster!

The natural capabilities of the coast line and indented creeks of Hayling Island for artificial aids in the culture of the oyster, which for unknown centuries had bred there first led, in 1865, to a private and successful attempt at raising spat, and afterwards to the formation of a company to enable the work to be carried out on a requisite scale. This Company have so far been most fortunate, although no returns will be seen for the outlay of capital in the raising of spat alone for two years to come, and its experience even thus far in the somewhat uncertain business of oyster raising is worth some attention from all who may have a weakness for the "inhabitant of the shell," or may take an interest, business or otherwise, in pisciculture.

The first great experiment made by the Hayling Oyster Fishery was made on the site of some old salterns at the south east extremity of the island, the entire water area experimented in being about $3\frac{1}{2}$ acres. The results of the

experiment were of a most unaccountable, although perfectly satisfactory character; and when we state that precisely similarly puzzling results have been obtained this year at the opposite side of the island, and on a very much larger area of water, we may possibly have said enough to fully rouse the interest of the reader.

In the spring of 1866 two *parcs* were prepared for the old oysters to throw off their spat in—one on the plan pursued on Lake Fusaro, in Italy, and the other on the French plan pursued on the Ile de Ré. The Fusaro bed, as we may term it for plainness of description, was of about 3 feet depth of water, which, as a general rule, might be considered as still water, fresh water only being admitted at spring tides through a sluice gate from the harbour outside the banks of the oyster farm. The bed of this *parc* was partly covered with shingle, and on this shingle were laid early in April 50,000 oysters from the deep sea beds; light and flat hurdles formed of hazel sticks and brushwood were laid over the oysters, and held by stakes in the bed of the pond a certain distance above them. The other bed, on the plan of the French at Ile de Ré, was entirely laid with shingle (over the saltern beds), and had a constant yet gentle running stream of water passing over it. In lieu of using hazel stick hurdles for collecting the spat, tiles were laid down. Both ponds, or *parcs* were connected by a narrow waterway, through which the water flowed from the Fusaro into the Ile de Ré beds. There was no material difference in the time of laying down the oysters in either bed, nor was there any difference in the quality of either. The result of this experiment was that while the pond on the lake Fusaro plan was filled with spat at spawning time, the other pond held no spat, nor was any thrown off by its oysters subsequently. The spat was first discovered in the

first week in June in the Fusaro pond, and there was no second display.

Unfortunately for this supply of young oysterlings, really magnificent by reason of their number and the manner in which they had thriven by the beginning of the following September, it was determined, contrary to the advice of the company's manager, to allow the young oysters to remain attached to the hurdles in their first position for a certain time, and until they had obtained a larger size. The consequence was that the shell of the growing babies grew round the sticks of the hurdles, and in subsequently removing them the under shell was broken in three cases out of four, and 75 per cent. of the fish destroyed.

The oysters that did not suffer from this barbarous detaching process at a wrong period of life are now flourishing amazingly in *parcs* specially prepared for their comfort and growth on the site of the Ile de Ré bed of last year's experiment, and which has now undergone an entire remodelling and arrangement. In their new home the oyster spat gathered and saved from off the hurdles laid over the oysters in the Fusaro *parc* now measure from a *minimum* size of one inch to a maximum of two inches in diameter. In September, 1869, these oysters will be in the market for consumption on our tables. The successful experiment of 1866 in the Fusaro water was, of course, repeated last year with, as nearly as possible, the same preliminary attendant conditions. Strangely enough, however, and curiously illustrative, as it proves, of the uncertainty of oyster hatching, no spat rose last year from the depths of what promised the year before to be the richest oyster mine in England. No known and reliable theory

can account for this striking difference in the marked success of one year and the failure of the next.

This part of the company's grounds has been re-arranged. They now comprise one breeding-pond (the old Fusaro water) empty, and cleaning out in readiness for future operations, with six acres of water space, divided into nine *parcs*, lying parallel with each other. Each *parc* is enclosed by puddled clay walls, lined with chalk blocks, and has its water sluice at the head and foot. The floor, or bed, is made of shingle sand, and has a fall of about twenty inches, from head to foot. A reservoir trench, running across the head of the *parcs*, and having communication with the harbour waters, gives a means of water supply to the *parcs* through the head sluices, and a cleansing of their bed by rushing the water through them and out through the foot sluices into the drain trench. The latter also acts as a canal for the flat-boat in any visit to the *parcs*, and their contents. It is a very important fact that in the shallowest of these *parcs* during last winter not one of the young oysterlings of the previous summer's spat was known to have been killed by the cold weather or frost.

It is now time to return to the three-months old oysterlings left imprisoned in the 18-acre *parc* at the opposite extremity of the island.

In September, 1866, the company's engineer had just commenced operations for the formation of *parcs* and other inclosed spaces on the north-west shore of the island, the walls of No. 1 *parc* being at no great distance from the bridge across the narrow channel which separates Havant from the island of Hayling. All then was in an embryo state; now there is one *parc* of 18 acres area, and one of seven acres, both in working order. There are

also ten acres laying out in parallel beds, with puddled clay and chalk-lined walls, trench and reservoir, as on the old Ile de Ré site, and a feeding reservoir of five acres. In addition, low walls have been commenced over a large area of shoals between two points of the coast, communicating channels are being cut for boat service between the shoals and "rythés" deepened, and 800 other and adjoining acres remain for any further extension of the present range of *parcs* which may be found requisite.

Our present purpose is to deal more with what has been done, however, than with what may be done here. The 18-acre *parc* and the adjoining one of seven acres were both stocked with oysters during the spring of the present year, the conditions in both cases being as nearly as possible alike; the oysters themselves, it is necessary to observe, being taken indiscriminately from one lot and deposited at the same time in both *parcs*. The water in both ranged from 5ft. to 6ft. in depth, and wattle-work hurdles of hazel sticks and fine twigs were staked down over the oysters, and at a certain height above them. Two thousand tubs of oysters were laid down, On the 1st of June the presence of spat was first discovered in the 18-acre *parc*, and by the 6th the births of the oyster baby hosts were evidently brought to a close for the season. Sixteen thousand hurdles were staked over the old oysters. These hurdles were next taken up, and the oysterlings then removed, with the bark, from the larger sticks by a number of men and lads employed for the purpose, and the smaller twigs cut into short lengths of four or five inches. These strips of bark and cut lengths of twigs, with the oysterlings attached in sizes varying from a pea to that of a large horse-bean, are then sent away to the *parcs* prepared for their reception and growth for market. Taking the lowest

estimate of the numbers of oysterlings on each of these hurdles taken up from the 18-acre *parc* as the spat there of the season, they cannot average less than 5000, giving a grand total of 80,000,000 young oysters as stock for market in 1870-1.

It was estimated in 1864 that seven hundred millions of oysters were consumed annually in London, and considerably more than that number in the provinces. With our growing population, annually increasing the number of oyster-eaters, what a grand future appears to be looming for oyster producers!

The following are the registered average temperatures of the water in the 18-acre *parc* at Hayling during the months of May, June, July, and August, taken 3 ft. under water, and in the shade by day:—

1867.	Maximum.	Minimum.
May.—By day	.. 61°	.. 55°
„ By night	.. 60°	.. 53°
June.—By day	.. 67°	.. 63°
„ By night	.. 65°	.. 62°
July.—By day	.. 70°	.. 65°
„ By night	.. 70°	.. 64°
Aug.—By day	.. 70°	.. 66°
„ By night	.. 70°	.. 65°

At the close of September last the *minimum* temperature of the air was found to be 43 deg.; the temperature of the water in the 18-acre *parc* at the same time was tested and found to be 58 deg.

At a meeting of the Food Committee, on December 11, 1867, Mr. Robert Atkin proposed to build a class of vessels of about 150 tons, fitted with wells, to keep the fish alive, with steam power adequate both for working side-screw propellers and for lifting the trawl net. The trawl

itself would be much larger than any now in use worked by manual labour, and by that means larger quantities of fish would be taken from deeper water than was now fished, and from which the best fish were obtained. He thought the great object would be to ensure certainty of a large supply of fish. The class of fishing vessels he proposed would be able to keep at sea in all weathers, and the fish would be kept alive till they were landed. He had fished with a trawl in 100 fathoms of water. He considered the fishing vessels at present used were too small, as well as the trawls which they used. He was well acquainted with the fisheries of the North Sea and the Baltic, as well as on the coasts of India and China, and he considered the Chinese left us in the shade entirely in their fisheries, both in the rivers and in the sea. The present small fishing vessels had not the power to drag such a trawl as would ensure much larger catches of fish from deeper waters. The nets he proposed would be stronger as well as larger than those ordinarily employed.

Mr. Atkin expressed his opinion that, by means of this enlarged scale of operations, great additions might be made to the supply of oysters from *beds at present inaccessible*. The English and French oyster fishermen dredged only to a depth of about 30 fathoms, but no doubt much *larger supplies might be obtained from beds which would be found in deeper water*. He proposed that dredging should be carried on upon a larger scale, and employing larger dredges to be worked by steam power, which could also be applied to the working of a side screw as auxiliary propulsion of the vessel. He believed that *large oyster beds existed on the Dogger Bank*. As oysters were now selling in London at 2d. *each*, it would be worth while to increase the supply and reduce the price. He proposed to adopt the plan which

was carried out in America—viz., when any large supply of oysters was obtained to take the fish out of the shells and pack them in cases. In New York, oysters treated in that way were sold at 4d. per lb., which was remarkably cheap compared with the price charged in this country. (Journal of the Society of Arts.)

We add some incidental details of the progress of the French Fisheries.

In a paper addressed to the Société d'Acclimatation, M. Delidon makes some interesting remarks on the state of Ostreiculture in the commune of Marennes, Charente-Inférieure, and especially on the artificial oyster-beds of the rock of Der.

M. Delidon considers the current as the natural vehicle by which the spat of the oyster is carried to those places where it finds suitable materials to fix itself upon.

But if no obstacles be put in the way of the current, an immense quantity of the spat will be taken out to the open sea and utterly lost, and it is to avoid this that collectors are formed. The ancient Romans used to make them of timber, and this material is used to this day with perfect success, with the single drawback that timber is not very durable. Stone, sea-shells, and tiles, therefore, answer much better; but even these are not unattended by annoyance, for as the oyster only travels once in his life—that is, in the state of spat, it becomes necessary after a certain time, in order not to be at the expense of multiplying the collectors, to detach the young oysters from the stone or tile, and transfer it to the definitive oyster-bed.

Now, in this preliminary operation at least 25 per cent. of the young oysters are destroyed, because of the thinness of their shells, which break in the attempt of separating them from the tile or stone. This serious loss

is partly owing, according to M. Delidon, to the clumsy shape of the knife with which the operation is performed ; but, in a great measure, also to the circumstance that the oyster is fixed to the naked tile or stone, whereas, if the latter were coated with some substance that would resist the action of the water, but could be removed without much difficulty, by mechanical means, all this loss might be obviated. M. Delidon recommends for this purpose a composition he has tried successfully for the space of two years, and consisting of plaster of Paris made up into a paste with oil.

The Calais oyster would be in great request did not its weight and size prevent its transport. It is described as white and of a very delicate flavour, and is taken from a bed remarkably clean and free from mud, about $2\frac{1}{2}$ kilometres to the north of the harbour. The average weight of these oysters is about 71 English pounds per 100 oysters. Their sale is, therefore, limited in a great measure to the immediate neighbourhood ; some are sent to St. Omer, and even to Lille and Arras, but beyond that point the cost of carriage becomes too great, and consequently not more than five boats from the port of Calais engage in the trade. These five boats, however, take from 558,000 to 620,000 oysters annually, which fetched from 35*s.* to 40*s.* per grand mille, or 1,240 oysters, and in dear seasons are sold at 50*s.* and even 60*s.* per grand mille.

I extract the following paragraph relative to Oyster Culture in England, from a recent number of "Sale and Exchange," (1889).—

"Every year the demand increases, and though, for a time, it may be easy for the capitalist who establishes new beds to see his money back, those who hold on must realise very handsome returns so as to give a very fair

average on the capital employed, especially as there is no material reduction in the price Natural oysters in Europe are not to be found in many places or in considerable quantities. The crop of oysters is as much a question of cultivation as a crop of cereals, and as there are many spots suitable for cultivation, in addition to those already employed for that purpose, we can only hope that the number of them made practically available will increase from year to year.

“We believe in ‘Natives,’ and if it is too much to ask that they shall be born here, let us at least have them naturalized in our beds at a very early period of their history, and fattened to the taste which has so long been cultivated amongst us. It is not merely a question of food, but the industry gives employment to a large number of people, (*a*) and, in Whitstable alone, the capital employed is considerably over half-a-million sterling and increasing yearly. We ought to grow our own supply, and it is not pleasant to reflect that we import 100,000 barrels from America. It is uncomfortable to think that a quarter of a century would barely suffice to restore European beds to their full powers of production, but it is clear, with an ever growing demand, prompt, large, and vigorous measures should be taken to produce an adequate and permanent supply. If oyster cultivators will ‘eat their corn in the grass,’ by exhausting their beds, they deserve to suffer the consequences of greed. What we do not like in the affair is that the oyster farmers cannot be punished for their own covetousness and imprudence, without punishing the consumer

(*a*) How many, I have no means of learning at this moment, but it may prove of interest to the reader to know that “120,000 fishermen are always afloat round our coasts gathering in the Harvest of the Sea.”

too, by the unnatural increase of prices to an almost prohibitive point."

Happily this increase of price is not often the case, but, that consumers in general suffer, but too frequently will be seen in the following newspaper report for the season in 1889.

"There is an abundant supply of oysters this season, and, although the retail prices are somewhat less exorbitant than usual, the wholesale trade complains that most fishmongers do not permit the public fully to profit by the recent fall in the market quotations. As compared with last year, the best Colne natives bring 4/- a hundred less at Billingsgate, the present figure being 16/- to 18/-; but the retail prices still range from 3/- to 4/- a dozen. As a matter of fact, nearly the only purchasers are one or two City restaurants and the West-end clubs and families. It is believed that merchants have large supplies on hand at Burnham and elsewhere, but they are not disposed to accept lower rates until compelled, an event which is confidently expected. Meanwhile the general public are buying largely of Dutch oysters, the retail price of which is 2/- a dozen for large sizes and 1/6 for seconds, the difference being that the former have been laying for three years and the latter for two. In appearance, although the shell is smooth, a Dutch oyster cannot compare with a Whitstable native, but the flavour is adjudged excellent, and the public are quite satisfied. According to the report of the committee appointed to adjudicate on the various exhibits of live oysters at the International Fisheries Exhibition of 1883, the awards were determined by the following considerations: Production, from the native spat to the marketable oyster was held of primary importance; then the cultivation of transplanted 'brood' and

oysters termed 'ware' and 'half ware'; and next regard was had to the shell, quality of fish, substance, flavour, colour and general appearance. After the English those of the Dutch Society in all points were highly commended.

But Dutch oysters, of which about nine millions—or half the total production of Holland—came into this country last year, can, it is said, never be cheaper, the Netherlands Government charging high rents for the beds, which are near Flushing, and it has been found on experiment that the oysters will not live transplanted to English waters. The cheapest oyster at present in the market is the American, imported direct and not requiring to be relaid. It can sometimes be sold at 2/- per hundred, and the season, commencing in November, lasts until the end of May.

There are three varieties, viz., 'Sounds,' sold wholesale at 30/- per barrel; East Rivers, at 35/-; and Blue Points, at 42/-. Few of the first mentioned are in the market, but large consignments of East Rivers and Blue Points of excellent quality are arriving.

Relaid Americans fetch from 40/- to 45/-, and are quite as dear as the Anglo-Portuguese, the price of which is 35/- per 1,000. It is the custom for English cultivators to lay down great quantities of American oysters in the spring, and it is considered that three months in English waters is sufficient to impart the desired appearance and flavour. For relaying purposes, however, the Portuguese appear to be the most popular, the reason being that this description can be sold cheaply, as it grows quickly on our shores, and fattens and can stand the cold of an English winter. An Anglo-Portuguese is marketable when eighteen months old, whilst the age of a Burnham native is generally three years. The shell of the Portuguese is,

however, of rugged appearance, and less sightly than the long oval-shaped smooth Blue Point.

As the quality of the fish is not indicated by its exterior, it is believed that this kind will become the cheap and popular oyster of the future.

A singular and most important feature of the trade has been the immense natural spat of Portuguese in the Medway, principally at Sharfleet, where the parent oysters were laid some time ago. The Portuguese oysters are obtainable all the year round, and have thus the advantage of 'direct' Americans. The close season does not apply to them; this is, indeed, in practice, a dead letter, for English oysters represent a small proportion merely of the business done, and are in very poor condition when their sale is interdicted. There is prospect also of a large supply of French oysters coming to the southern coasts.

Last spring about 25,000,000 were exported thence to England, and the returns are likely to grow larger from year to year. Anglo-French oysters sell from 50/- per 1,000, but Franco-Dutch—i.e., those which have been relaid in Holland—command 70/- to 80/-, and these oysters practically have carried the trade during the whole season, having been superior to the same variety when put down in home waters on the Kent or Essex coasts.

Among other places, Southend has become an important ground. Billingsgate retains almost the monopoly of the better class trade, but the minor markets concern themselves chiefly with the sale of the cheaper sorts.

At the Central Fish Market Dutch oysters imported direct are made a speciality, and they are retailed at a moderate profit. As a rule, however, the suburban fishmonger neither vends an oyster by its true name nor at its proper price.

Dutch are passed off for Colchester natives, and 1/6 and 2/- a dozen is charged for Scotch oysters which are probably American, as Scotland, together with Ireland, has, it is explained, ceased to furnish an appreciable yield of natives for the London Market."



CHAPTER XVIII.

OYSTER CULTURE IN ENGLAND.

THE WHITSTABLE FISHERIES.

THE ISLE OF SHEPPEY, THE MEDWAY, AND WHITSTABLE—ECONOMY OF AN OYSTER FARM—METHOD OF WORKING THE WHITSTABLE FISHERY—THE PONT FISHERIES—PRICE OF AND QUANTITY OF “BROOD,” “WARE,” AND OYSTERS IN A LONDON BUSHEL—“COMMONS”—“NATIVES”—“PLANTING”—HOW TO TELL A WHITSTABLE NATIVE—ENORMOUS INCREASE OF PRICES—CLANNISHNESS OF THE WHITSTABLE OYSTER FISHERS—MR. SIBERT SAUNDERS’S MUSEUM OF PRACTICAL BENEFIT TO THE DREDGERS—RISE AND FALL OF PRICES—HOPES FOR THE FUTURE.

Who that has travelled by water from London Bridge to Herne Bay—and who among us who live within the sound of Bow Bells has not?—should the trip have been made in the beginning of August, but must have noticed, after having passed the Isle of Sheppey, a little fishing town to the right, in East Swale Bay, raising its head out of the river like a joyous child dressed in its gayest attire, anticipating a long-looked for holiday? It is the 4th of August, and its holiday is at hand, for to-morrow the oyster season begins; and the town is Whitstable, in Kent, standing out

gaily with its bright flags and pennons in beautiful relief from the low marshy soil by which it is surrounded. Then, too, the dredgers, in their picturesque costume, add greatly to the gay appearance of the place, whilst some seventy or eighty vessels lying in the offing bespeak the importance of the oyster traffic between it and the great Metropolis. What the Lucrine was to the citizen of Rome is the estuary of the Medway with the Swale to the citizen of London.

(a)

Whitstable was a fishing-town of note in the reign of Henry VIII., and was called in ancient records "Northwood." Leland, in his "Itinerary," thus describes it:—"Whitstable is upward yunto Kent, a ii miles or more beyond Faversham, on the same shore, a great fisher-towne of one parochie, belonging to Plaze College, in Essex, and yt standeth on the se-shore. Ther about they dragge for oysters,"

What Whitstable is now, in regard to its oyster fishery, is described in the present chapter, and although I cannot say that the subject is exhausted herein, I am led to hope that the account given will furnish the reader with a good idea of its wealth, importance, and, I may add, its good fortune, for its oyster beds have been so very prosperous as to have attained the name of the "happy fishing-grounds,"

Before, however, entering upon relative details let us take a hasty glance at the economy of an English oyster farm.

"A LARGE oyster-farm requires a great deal of careful attention, and several people are necessary to keep it in order. If the farm be planted in a bay where the water is very shallow, there is great danger of the stock suffering from frost; and again, if the brood be laid down in very

deep water, the oysters do not fatten or grow rapidly enough for profit. In dredging, the whole of the oysters, as they are hauled on board, should be carefully examined and picked; all below a certain size ought to be returned to the water till their beards have grown large enough. In winter, if the beds be in shallow water, the tender brood must be placed in a pit for protection from the frost; which of course takes up a great deal of time. Dead oysters ought to be carefully removed from the beds. The proprietors of private 'layings' are generally careful on this point, and put themselves to great trouble every spring to lift or overhaul all their stock in order to remove the dead or diseased. Mussels must be carefully rooted out from the beds; otherwise they would in a short time render them valueless.

The layings, for example, of Mr. David Plunkett, in Killery Bay, for which he had a license from the Irish Board of Fisheries, were overrun by mussels, and so rendered almost valueless.

The weeding and tending of an oyster-bed requires, therefore, much labour, and involves either a partnership of several people—which is usual enough, as at Whitstable—or at least the employment of several dredgersmen and labourers. But, for all that, an oyster-farm may be made a most lucrative concern.

As a guide to the working of a very large oyster-farm—say a concern of £70,000 a year or thereabout—I shall give immediately some data of the Whitstable Free Dredgers' Company; but I wish first to say that the organization which is constantly at work for supplying the great metropolis with oysters is more perfect than can be said of any other branch of the fish trade.

In oyster culture we approach in some degree to the French, although we do not, as they do, except as regards some new companies, begin at the beginning and plant the seed. All that we have yet achieved is the art of nursing the young 'brood,' and of dividing and keeping separate the different kinds of oysters. This is done in parks or farms on various portions of the coasts of Kent and Essex, and the whole process, from beginning to end, may be viewed at Whitstable, where there is a large oyster ground and a fine fleet of boats kept for the purpose of dredging and planting.

I have already stated that the Whitstable oyster beds are held as by a joint stock company, into which, however, there is no other way of entrance than by birth, as none but the free dredgers of the town can hold shares. When a man dies his interest in the company dies with him, but his widow—if he was a married man—obtains a pension.

The sales from the public and private beds of Whitstable sometimes attain a total of £200,000 per annum. The business of the company is managed by twelve directors, who are known as 'the Jury.'

The stock of oysters held in the private layings of the company is said to be of the value of £200,000. The extent of the public and other oyster-grounds at Whitstable is about twenty-seven square miles.

The oyster-farm of Whitstable is a co-operation in the best sense of the term, and has been in existence for a long period ; it is the wealthiest and largest oyster corporation in the world. The layings at Whitstable occupy about a mile and a half square. At Whitstable, Faversham, and adjoining grounds, a space of twenty-seven square miles, as I have mentioned above, is taken up in oyster-farms,

and the industry carried on in this space of ground involves the annual earning and expenditure of a very large sum of money. Over 3000 people are employed in the various industries connected with the fishery, who earn capital wages all the year round—the sum paid for labour by the different companies being set down at over £160,000 per annum; and in addition to this expenditure for wages, there is likewise a large sum of money annually expended for the repairing and purchasing of boats, sails, dredges, and other implements used in oyster-fishing.

At Whitstable the course of work is as follows:—The business of the company is to feed oysters for the London and other markets: for this purpose they buy brood or spat, and lay it down in their beds to grow. When the company's own oysters produce a spat—that is, when the spawn or 'floatsome' as the dredgers call it, emitted from their own beds falls upon their own ground—it is of great benefit to them, as it saves purchases of brood to the extent of what has fallen; but this falling of the spat is in a great degree accidental, for no rule can be laid down as to when the oysters spawn or where the spat may be carried to. No artificial contrivances of the kind known in France have yet been used in Whitstable for the saving of the spawn. Very large sums have been paid in some years by the Whitstable company for brood with which to stock their grounds, great quantities being collected from the Essex side, there being a number of people who derive a comfortable income from collecting oyster brood on the public foreshores, and disposing of it to persons who have private nurseries, or oyster-layings as these are locally called.

The grounds of Pont are particularly fruitful in spat, and yield large quantities to all that require it. Pont is an

open space of water, sixteen miles long by three broad, free to all; about one hundred and fifty boats, each with a crew of three or four men, find constant employment upon it, in obtaining young oysters, which they sell to the neighbouring oyster-farmers, although it is certain that the brood thus freely obtained must have floated out of beds belonging to the purchasers. The price of brood is often as high as fifty shillings per bushel, (*b*) and it is the sum obtained over this cost price that must be looked to for the paying of wages and the realisation of profit. Oysters have risen in price very much of late years, and brood has also, in consequence of the scarcity of spat, been proportionally high.

Whitstable oyster-beds are 'worked' with great industry, and it is the process of 'working' that gives employment to so many people (eight men per acre are employed), and improves the Whitstable oysters so much beyond those found on the natural beds, which are known as 'Commons,' in contradistinction to the bred oysters of Whitstable and other grounds, which are called 'natives.' These latter are justly considered to be of superior flavour,

(*b*) The author of "The Oyster," &c., (1863) says:—" that in the Essex Fisheries at Pont, a considerable trade is carried on in 'Brood,' the price of which varies from 4/- to 5/6 per 'wash,' which is two pecks at Colchester, or one in London. Mr. Hawkins gives the complement of oysters in a 'wash' as follows:—'During the first year, the spat cannot be numbered; the second year brood, 1,600; third year ware, 600, and the fourth year oysters, 400. A London bushel of the first year, consists of spat, the number of which cannot be ascertained; of the second year brood, 6400; of third year ware, 2400; and of fourth year oysters, 1600. These figures show a four-fold increase in three years; or, in other words, four wash of brood (i.e. four pecks), purchased at say 5/- per wash, increase by growth and corresponding value to 42/- per wash, or a sum of eight guineas.'"

although no particular reason can be given for their being so, and indeed in many instances they are not natives at all—that is in the sense of being spatted on the ground—but are, on the contrary, a grand mixture of all kinds of oysters, brood being brought from Prestonpans and Newhaven in the Firth of Forth, and from many other places, to augment the stock.

The so-called ‘native’ oysters—and the name is usually applied to all that are bred in the estuary of the Thames—are very large in flesh, succulent and delicate in flavour, and fetch a much higher price than any other oyster. The beds of natives are all situated on the London clay, or on similar formations. There can, however, be no doubt that the difference in flavour and quantity of flesh is obtained by the Thames system of transplanting and working that is vigorously carried on over all the beds. Every year the whole extent of the layings is gone over and examined by means of the dredge; successive portions are dredged over day by day, till it may be said that almost every individual oyster is examined. On the occasion of these examinations, the brood is detached from the cultch, double oysters are separated, and all kinds of enemies—and these are very numerous—are seized upon and killed.

It requires about eight men per acre to work the beds effectually. During three days a week, dredging for what is called the ‘planting’ is carried on; that is, the transference of the oysters from one place to another, as may be thought suitable for their growth, and also the removing of dead ones, the clearing away of mussels, and so on. On the other three days of the week it becomes the duty of the men to dredge for the London market, when only so many are lifted as are required. A bell is carried round, and rung every morning, to rouse the dredgers

whose turn it is for duty, and who at a given signal start to do their portion of the 'stint.'

As to this working of the oyster beds, an eminent authority has said it is utterly useless to enclose a piece of ground and simply plant it; it is utterly useless to throw a lot of oysters down amongst every state of filth. You must keep constantly dredging, not only the bed itself, but the public beds outside, so as to keep the bottom fit for the reception and growth of the young oysters, and free of its multitudinous and natural enemies.

It may as well be explained here also, that what are called native beds are all cultivated beds; the natural beds are uncultivated, and are generally public and free to all comers. The Colne beds, however, are an exception; they are natural beds, but are held by the city of Colchester as property. Whenever a new bed is discovered anywhere nowadays, the run upon it is so great that it is at once despoiled of its shelly treasures; and the native beds would soon become exhausted if they were not systematically conducted on sound commercial principles, and regularly replenished with brood." (c)

In an interesting article in the London *Daily Telegraph* (Aug. 31st, 1885), headed

"WHITSTABLE AND HER NATIVES,"

the writer says:—" French oysters reared at Whitstable are too often sold as real Whitstable natives. The effect is mischievous in several ways. It vitiates taste, and confirms the unwary purchaser in an ignorance prejudicial to legitimate interests. Thus, let us say you have gone on for a little time ordering and paying for Whitstable natives, which are not natives at all; and suddenly, having

(c) "The Harvest of the Sea," pp. 254-8.

heard that the French are as good, you change your order, and, if your tradesman be not conscientious, obtain precisely the same thing at less cost. This is a satisfactory amendment as far as it goes ; but it discredits, most injuriously and unfairly, the 'genuine article.'

Complaint is loudly made by the Whitstable Company of dredgers, who have gone so far as to threaten proceedings at law. No doubt a purchaser who could prove that he had been deceived, and had paid for that which was not supplied to him, would have his remedy. But in nine cases out of ten he would not know, and in the tenth he might not care. What is to be done ? Obviously, Whitstable cannot put her official seal or trade-mark on every native oyster sent up to London by rail. Is there no other precaution against deception ?

Fortunately, yes. The much-desired seal or trade-mark is set by nature herself on each shell ; and a little attention to distinctive signs will protect every consumer against imposition. It is not very easy to describe on paper the outside difference between natives and foreigners, whose education has been finished at Whitstable. But when their inner qualities are unfolded there is no difficulty whatever.

Take the shell on which an open oyster has been handed to you, and when you have cleared the way for vision by swallowing the mollusc, look at the smooth empty surface of mother-o'-pearl. If you have the relic of a real Whitstable native in hand, the iridescent whiteness of the shell will either be stainless or else only marked here and there with a faint bluish tinge. If, on the contrary, the shell be that of an oyster spatting elsewhere than in the estuary of the Thames, even though its after-growth shall have enjoyed the advantage afforded by a Whitstable

polish, you will see deep stains resembling those of 'a black-eye in the green stage of recovery.' Accompanying these will be a coarse chalkiness, very different from the delicate nacre of a true native.

Perhaps, however, it will be best to rely on the colour alone, as the variation of texture is merely a comparative indication; while the presence or absence of deep colour is a positive, certain, and unmistakeable fact. Remember, a Whitstable native has the very faintest tinge of violet-blue inside the shell, if, indeed, the white be not, as it more commonly is, free from any stain at all.

At the best-reputed oyster shops in London, bearing names that bespeak the excellence of everything which is served there, no attempt to palm off Colchester oysters—which, by the bye, are quite good enough to stand on their own merits—is ever made. It is from Colchester, principally, or from adjacent parts of the Essex coast, that oyster-spat is procured for the Whitstable culture; the northern shore of the estuary being the best producing ground, but not so suitable for development as the Kentish coast within the Foreland. Most desirable is it, therefore, that amicable relations should exist between Colchester and Whitstable; and if, indeed, something like a compact could be signed and sealed between them, we might soon see the finest oysters nearly as cheap as ever, to the commercial benefit of both places.

Hitherto, it must be confessed, the greed of certain Essex traders in spat has been the main, if not the sole cause of scarcity in the supply of well matured native oysters. In the year 1859, just before English oyster-eaters bade a long adieu to the old prices, 6/- a tub, which means the old London bushel of twenty gallons, was given for Colchester spat. The price demanded and obtained

last year, for the same quantity, was £45. This enormous increase, the public will be glad to hear, has reached its culmination, and the turning point having been gained, a very perceptible abatement of the over-charge has commenced.

. . . . Fifty millions of oysters always lie on the Whitstable beds. The term 'native,' be it understood, properly includes those oysters, and those alone, which are bred in the Thames estuary, their fineness falling off as they advance eastward towards the Naze and the North Foreland. For ages the right of oyster-dredging was held under license from the lords of the manor, and the place was described by Leland as already quoted.

It was not, however, till 1793 that an Act of Parliament was obtained incorporating the Company of Free Fishers and Dredgers of Whitstable, and granting them a common seal. Since that year, the company has regularly held, each July, its water-court, presided over by its steward. Only 'freemen' are allowed on the grounds, and so rigidly is this rule enforced, even to the letter, that, even if Saturday's boisterous gale had not hindered the operations, those visitors who had been bidden as honoured guests of the Dredgers' Company (alluded to in the beginning of this article, but omitted in quotation,) would not have been admitted on board any of the boats, except by a special and most extraordinary concession, formally sanctioned by all the members. Generations of exclusiveness have naturally led to a state of clannishness, in which a few family-names go a great way in a population of less than 5000 souls. In fact the Ganns, Kemps, and Nichollses, have it pretty much to themselves, other inhabitants of the town being more or less strangers within its gates,

entertained tolerantly, and living there under some sort of unwritten letters of naturalisation.

The new museum, only occupying at present the ground floor of a house in Whitstable's one street, has been justly praised as a practical aid to local improvement.

Beholden for its foundation to the banker of the town, Mr. Sibert Saunders, an enthusiastic archæologist and student of natural history, it contains within a small compass much to inform the observant eye and retentive mind concerning the various phenomena of the surrounding neighbourhood. 'Infinite riches in a little room' is a golden legend, as fitting for a select gathering of instructive objects, that is to say, a carefully and intelligently formed museum—not a crowded and confused assembly of irrelevant oddities—as for a library.

The mere addition of a working microscope has in a few weeks taught the Whitstable dredgers a great deal more about the oyster than the oldest and most experienced among them ever knew before ; the knowledge thus newly imparted being by no means of the uselessly curious order. They are now fully acquainted with the nature of what they have been calling spat, with but the haziest ideas of its energetic life and impulse. Only a short time ago they fancied the turbid fluid, with minute granulations, became hardened on the surface of the water, till it deposited itself in fragments which gradually form themselves into oysters.

Not alone to dredgers, but to many a man of so-called education, the early microscopic existence of the oyster is a novelty and a marvel. Each speck in the multitude of seemingly inorganic particles, clouding a drop of this fluid, is seen, under the lens, to be an active little creature, . . . and when the oyster-fisher is told, upon evidence which he can have no great difficulty in accepting,

that every oyster produced about a million of these free-swimming chicks or children, he can easily understand why they should be reared with care. Of their growth, his unaided eye has made him tolerably cognisant. . . . It is of the spat in its microscopic stage that the dredger, really concerned in knowing his business, knew little, and needed to know much. He has been taught the value of such knowledge, and is already convinced, or at least open to conviction, that, inasmuch as oysters continue spatting as late as October, it would be well to prolong the close season by a full four weeks. Regarding the food of the oyster, he has always laughed at the absurd cockney theory touching oatmeal as a fattener. When reposing on the bottom, the oyster should lie on the convex shell; of course the helpless creature has to remain in the position it fell into when cast overboard; it may have fallen on the convex shell and turned over by the action of the water or scouring of the dredge, &c. After being landed, and deprived of the infusorial food which is constantly supplied to him while he remains stationary below the sea, it is wise to keep him in this position, that is, with his deep shell downwards, and to cover him and any number of his companions with a cloth, to keep away all draughts of air. The oyster then feeds for two or three days on the liquor shut within his shell. To give him meal, or mealy water, is to hasten his end. When an oyster is going to die, he grows fat, and meal both fattens and kills him."

As an illustration of the above extract, the following quotation from the *Standard*, March 19, 1885, will prove interesting and instructive:—

"There is good news for oyster-eaters, as authorities agree that next season will witness a very great reduction in the price of the delicious mollusc. Indeed, the prices

for stock for re-planting has diminished from thirty to forty per cent. below current prices at this time last year. This deduction is not owing to any legislative interference, so much advocated by alarmists, who thought the oyster was doomed to extinction, but rather through the vast recuperative powers possessed by this extraordinary shell-fish.

“To go back to the years 1857, '58, and '59, when successively each year witnessed a heavy fall of oyster spat, will enable us to better comprehend the rise and decline of the almost fabulous price obtained for the British 'native.' The enormous quantities of young oysters which fell in the estuary of the Thames during the above years created a stock of such vast proportions, that it alone continued to supply the market for many following years.

“In the Exhibition year of 1862 these oysters were coming to marketable size, and the demand in London alone was so enormous that during the season it was a common occurrence to witness from twelve to fourteen oyster boats lying at Billingsgate delivering their cargoes.

“The wholesale price for best natives at that time was two guineas per bushel of twenty-two gallons, or thereabouts, and which would contain sixteen hundred oysters, being at the rate of about two shillings and sixpence per hundred (the price of a dozen now), so that retailers could and did in those palmy days retail best natives at sixpence and eightpence per dozen.

“Then came a failure of spat; Nature, who had been so prolific during the afore-mentioned years, suspended her gifts, and oyster-culturists had many years of absolute famine. But the taste which had been acquired, and the facilities of carriage consequent on the opening up of rail-

ways at that time, created a demand which began to tell on the stocks accumulated during the time of plenty.

“Recognising the difficulty of replacing the oysters that were being so rapidly consumed, proprietors, in 1863, began to raise their prices by an increase at first of a few shillings per bushel. Gradually the price rose to fifty shillings, then to three pounds, and it was thought by many that the end of the oyster trade was near when it was proposed to ask four guineas.

“The year 1866 brought a little spat, and from that time down to 1881, the rivers in Essex had been favoured with occasional falls, but not in such quantities as to materially affect the supply. Notwithstanding the continued rise in price, the public taste and appetite seemed to become keener, and then the price went up by leaps and bounds of two guineas and more at a time, until it fetched last season the remarkably high sum of sixteen pounds per bushel, or by numbers, at the rate of half-a-crown per dozen wholesale price for best natives.

“The climax has been reached, and the value is now tumbling down more rapidly than it went up, and will do so until it settles at its normal level. There is a vast consumption of oysters in this country, and many millions of foreign oysters are annually consumed. This demand will prevent English oysters from going a-begging, for as soon as the price comes within the limits of the pockets of the million the downward fall will be arrested. This promised plentiful supply is due to an extraordinary fall of spat in the rivers in Essex and on the grounds at their mouths during the summer of 1881. Scarcely a laying in clean condition failed to receive some of this gift from Nature, while at the entrances to the Blackwater and the Colne, as well as along the coast, millions of young oysters

were deposited. The winter following being very favourable for its development, and the next summer being genial, its growth was rapid, so that it was of marketable size during the latter part of the summer of 1882. From July to October in that year as many as two hundred sail of boats, each having from three to four men, were engaged dredging up the baby oysters and selling them to proprietors of layings. Here was over-dredging with a vengeance. There was certainly enough to make the advocates of stringent legislation to prevent denudation of beds weep and tear their hair in despair. But, fortunately, at that time they happened to be asleep, and no one cared to awaken them, for fear of the incalculable mischief that might probably have been done through their misrepresentations. It has been estimated that from the grounds at the mouth of the river Blackwater and along the coast below the Colne during the above period—in 1882—from ten to twelve million young oysters were collected and deposited in private layings, there to receive the protection and care necessary for their proper development into a mature nature.

“The growth in the summer of 1882 was sufficient to place the young brood safely beyond the risk of the rigours of an ordinary winter, so that in the following summer more important work was obtained on these common grounds, and many millions more of young brood were dredged up. It is this spat which is now affecting the market. Ordinarily, it takes from four to five years to bring an oyster to marketable size; but the fine summers and mild winters we have experienced lately have induced a growth on oysters equal to five ordinary years, so that the greater bulk of the spat of 1881 will be fit for market next season. Last summer also gave a very heavy fall of

spat, and the mild winter we have passed through warrants us in hoping and looking for another supply equal to that of 1881.

“ A comparison of prices will enable the reader the better to comprehend the influence of the increased supply of young brood, or the prospects of cheaper oysters.

“ Last season the price of ware for replanting on Kentish beds ranged from £12 to £14 per tub of 1,800 to 1,900 oysters ; this season the price for the very best stuff of the same number is from £7 to £8 per tub. This reduction, looking at the stocks held by the principal owners, should bring next season's market price for best natives down to 12s. or 14s. per hundred. Indeed, other causes may work to bring prices even lower, for merchants having large stocks, in the face of the heavy fall of last year, are anxious to realise, and, in the absence of demand from Kentish buyers, are obtaining grounds on the Kentish coast for fattening oysters they cannot otherwise sell.

“ This fall in price, being from a natural cause, consequent upon the bountiful supply, will be profitable to the growers, as will be patent to the most unsophisticated when it is stated that the stuff purchased in 1882, at from one shilling to two-and-sixpence per hundred, has every prospect of realising from 12s. to 14s. for the same number. Nay, independent of the quality of the fish, the value arising only from the size of the shells, this same stuff at present is realising from nine to ten shillings per hundred, or an average of 400 per cent. in little more than two years.”

CHAPTER XIX.

OYSTER CULTURE IN ENGLAND.

THE POOLE OYSTER FISHERIES.

POOLE AND ITS OYSTER TRADE IN OLDEN TIMES—G. C. BENTINCK, ESQ., M.P., AND THE POOLE FISHERMEN—SUICIDAL POLICY OF THE FISHERMEN—THE FRENCH SYSTEM TRIED IN POOLE HARBOUR—UNSUCCESSFUL; AND WHY—THE POOLE OYSTER FISHERIES COMPANY—OPPOSITION FRUSTRATED—MEDICAL OPINION ON THE POOLE OYSTERS—THE TAGUS OYSTER IN FRANCE—RESULTS OF AN AFTERNOON'S DREDGING—PRIMITIVE NOTIONS OF THE FISHERMEN CONCERNING OYSTERS, ETC.—LARGE-SIZED OYSTERS—PEARL OYSTERS.

“POOLE points proudly to her oyster-bank, and tells miraculous tales of her fishery, and of the number of oysters she sends to the London market, besides those which are pickled at sea for the export trade to lands where a fresh oyster is still a luxury unknown. The Poole fishermen who open oysters in their boats for pickling are compelled by an Act of Legislature, to throw the shells on the strand, and these, in the course of time, have formed a strong barrier against the waves of the sea at the flow of the tide, having the appearance of an island at high-water; and, simple as it is, such is the sole construction of this celebrated breakwater.”—“*The Oyster*,” &c.

We read, in Britton's "History of Dorset," that there was an oyster-fishery in Poole Bay, and that though the town of Poole claimed much dominion in this bay, the Lord of Corfe Castle had a power and jurisdiction, as Admiral by Water and Land, on the seas round the Isle of Purbeck, on the high seas, and throughout the whole island, in pursuance of a grant by Queen Elizabeth to Sir Christopher Hatton. The fishermen of Wareham, upon paying a small fine to the Lord of Corfe Castle, have a right also to fish in these waters. (*a*)

In the reigns of James I., and Charles I., great quantities of oysters, taken in and near the harbour, were pickled, barrelled, and sent hence to London, Holland, the West Indies, Spain, and Italy. In 1747, in digging a dock for a ship on a tongue of land opposite the harbour called Hamworthy, a large bed of oyster shells was found six feet-and-a-half thick, regularly piled one upon another. The ligatures of most were visible. The whole bed was covered over with about a foot of black mould. But this was not a natural bed of oysters; for they had all been opened, the fishermen having a knack of taking them out without breaking the ligatures. They were formerly opened at Hamworthy, and the shells left on the shore; but, about 1640 or 1670, they were forbidden by the corporation, who imagined such encumbrances might injure the channel; on which they opened them in the boats on the mud, near the strand, and threw the shells there, by which that hill of shells was raised, which, at high water at least, is surrounded by the sea, and called the "Oyster bank."

(*a*) "Topographical and Historical Description of Dorset," by John Britton, Esq., and Mr. E. W. Brayley. p. 413.

Without the bar, and in the boundaries of Poole, is an extensive bed of oysters, from which there are several sloops loaded every year, and carried to creeks in the mouth of the river Thames, where they are laid to fatten, to supply the London markets ; and in catching of which upwards of forty sloops and boats are employed for two months every spring, which season is the fishermen's harvest ; during which time they receive between £6000 and £7000.

The last day's catching is, by a prescriptive regulation, thrown into the channel within the harbour, where they fatten, and supply the town and country during the winter with excellent oysters ; and thus was formed what is now termed the outer channel bed, and at present the only productive one ; and though numbers are still taken, it is apprehended that this oyster bed will dwindle and will shortly be exhausted, for the wholesome regulations for restraining the take, according to the state of the bed, and which were enforced under the ancient Admiralty jurisdiction, have since its abolition unfortunately been disregarded. The Poole oysters are held in high estimation, and rank next to those of Essex and Kent. (*b*)

Some attempts have been made to resuscitate the culture of oysters in this harbour, but, with the exception of the present Poole Oyster Fishery Company, the attempts have resulted in a loss to the originators.

The Rt. Hon. G. C. Bentinck, M.P., of Brownsea Island, in the year 1875, made application to the Board of Trade for a grant of the ground in front of the castle, and in South Deep, so that their beds might be preserved from complete destruction, but the fishermen being strongly

opposed to it, the Corporation of Poole joined with them in petitioning against the grant. The Board of Trade appointed Sir Horace Walpole to hold an enquiry at the Guildhall, Poole, whereat the fishermen declared that Mr. Bentinck was "trying to rob them of their birthright," and that the portion of the harbour mentioned was by far the best fishing ground in the harbour. Mr. Bentinck, taking into consideration the opposition brought against his application,—notwithstanding the willingness of the Board of Trade to yield in his favour—generously and wisely withdrew his claim after having spent about £150 in his attempt to preserve the beds.

In 1867 a Monsieur—— from Arcachon, in France, induced the late Mr. Kemp Welch—who always took great interest in any movement for the benefit of Poole—to form a Company for breeding oysters on the same system as practised in France. About six acres of shallow ponds were farmed at the Sand-banks. In reference to this locality the Commander appointed by the French Admiralty to superintend the Oyster Fishing on the Coast of France reported—"Having carefully examined the Chart of Poole Harbour and the detailed description of those parts selected for the intended operations, it is my opinion that the situation is a splendid one for oyster beds and oyster culture."

The parent oysters from France and Poole Harbour were planted in these ponds, but what with the bad management and the unsuitableness of the place, this effort proved a failure; the ponds being so constructed that the tide left them dry daily, exposing the fish at low water to snow and frost in the winter, and to the hot sun in the summer months, instead of constructing the ponds so that they should always be full of water; and, what spat

was thrown, instead of being received on to Collectors, was carried into the bed of the harbour by the strong currents, and certainly went far to restock the exhausted beds in the channel, the benefit from which is felt even to this day.

The system not being practicable in this harbour, all interest in the scheme was given up by the originators, and as no strict watch was kept over the beds, the fishermen stole the oysters, and even dredged on the beds, and sold half-ware-spat and cultch at one shilling per bushel, to Oyster Cultivators in the Solent.

I may say here, it is much to be regretted—and to their shame be it recorded—that there was not a greater degree of honesty displayed by the purchasers, as, doubtless arrangements were made with the receivers, or, surely, otherwise, the fishermen would not have acted so dishonestly and with such suicidal policy to their own interest.

In 1881 Mr. J. M. Henderson surveyed the harbour for a suitable place to establish an Oyster Fishery and made application to the Corporation of Poole for a portion of the Wareham Channel; but, at a meeting of the said Corporation convened for the purpose of granting a lease, it was found they were powerless to do so. They, therefore, deeming it advisable to secure their position and interest, applied to the Board of Trade for a regulating order over the oyster beds in the harbour, which, in due course was granted. Thus empowered, they are now supposed to protect the grounds, to license boats for dredging purposes, and that the beds may be protected they have resuscitated the old office of Water Bailiff.

As Corporations are not permitted by the Board of Trade to sublet any portion of their grants, Mr. Henderson, on

behalf of his Company, (The Poole Oyster Fishery Company) applied direct to the Board of Trade for a grant over the Wareham Channel which was opposed by the fishermen, who—during the enquiry held at the Guildhall, before C. E. Fryer, Esq., Inspector of Fisheries,—stated, that the *said Channel* was the best fishing ground in the harbour.

This statement being made by one and all of them, the Inspector (after referring to the examinations before Mr. Walpole) asked some of the witnesses how they happened to say exactly the same thing with regard to Mr. Bentinck's application for the South Deep at the opposite end of the harbour? which question being unanswerable, at once proved that they were ready to swear anything to suit their purpose.

After this defeat, no further opposition being offered, the Board of Trade gave a grant for sixty years of about 200 acres in this Channel, which has since been cleaned and stocked with a very large quantity of oysters from Arcachon and other places, which are brought direct on to the grounds by steamer, and also native "halfware" for growing and fattening. And now, on the beds, can be seen large areas covered with spat—so many as seven and eight spat being found on a shell—which, as a natural result of the great quantities planted, is carried far and wide by the four knots tide and it is confidently expected that our famous beds will be again plentifully stocked with the luscious bivalves.

Besides the large and constant supply of oysters from Arcachon, the Poole Oyster Company (*c*) includes in its

(*c* This name was assumed in 1889 instead of that previously held—viz., "The Fowley Oyster Fishery Company, (Limited)."

Fowley Island is situated in Emsworth Harbour, about two miles from Havant.

business a contract with the Anglo-Portuguese Oyster Fisheries Company (Limited) for the annual supply of up to twenty millions of Anglo-Portuguese oysters, of mature and marketable size, direct from the Tagus, relative to which Dr. Arthur H. Hassell reports :—

“Tagus oysters in their natural or wet state contain ‘0098 grains per cent. of Iodine, equal to ‘0128 grains of Iodide of Potassium, and ‘0014 grains of Bromine, equal to ‘02 grains per cent. of Bromide of Potassium.

“The English oysters were carefully examined for Iodine and Bromine, but the traces found were so small as not to allow of the determination of the quantity.”

Dr. Abbots Smith, M.R.C.P., London, Physician to the North London Consumption Hospital, &c., says :—

“The ‘Anglo-Portugo’ oysters are of excellent quality and in good natural condition. Invalids and persons in delicate health will find these oysters specially suited for their use, as, in addition to their nourishing qualities, they are naturally impregnated with Iodine derived from the seawater, without in any degree affecting the delicate flavour which they possess.”

It may not be out of place here to mention that the Tagus oyster (*d*) is also largely cultivated in the French oyster beds. Its introduction and acclimatization in France are due to an accidental case. (*e*)

A vessel bound from Portugal was laden with a cargo of this oyster. Having entered the Gironde, after a long passage, the captain believing the oysters dead, threw the cargo overboard, upon an old oyster-bed named the

(*d*) *Ostrea angulata* (the *Gryphæa angulata* of Lamarck.)

(*e*) “Oyster culture in France,” Translation of Report, by M. Bouchon-Brandeleley, 1883.

Richard-bed. Having found in the Gironde a soil nearly identical with that which they came from, and conditions favourable to their propagation, the oysters multiplied in such proportions that from the Point de Grave to the above Richard-bed, an extent of thirty kilomètres, they form one vast bed.

The taste and flavour are very different to that of our native oysters; but, that its healthful alimental qualities make it none the less appreciated, is proved by the large consumption thereof both in England and France. It delights in muddy and brackish waters, and is suitable for sending long distances, as the lower shell is deep and holds much water. M. Paul Fischer says that it belongs essentially to the Littoral Zone, and is uncovered at each tide, and everywhere distributed where limpets are found. (f) The first importation of *ostrea angulata* to the Archacon-beds from Lisbon was in 1866.

“In the Bay of Cadiz *Ostrea Virginica* (or *Ostrea angulata*?) is eaten when very small, but the poor people eat it full-size, viz, ten inches long. This species lives in the salt mud of the Guadalete, and is called *Ostione*; others oysters are called *Ostrea* or *Ostrias*, and *Ostrea edulis* is known by the name of *Ostia blanca*. The river is said to be salt three leagues from its mouth.

A Frenchman at Puerto de Sta Maria, tried the experiment of breeding oysters for the Madrid market, but they were slimy, and not to be compared with the English oysters, though they were said to be good when cooked; and Major Byng Hall stated that at Madrid, oysters—not fine ones—cost twopence halfpenny (that is, I suppose, one real) each; but this is not very remarkable, for in 1865 (f) “*Journal de Conchyliologie*,” 3ième Serie, tome 20, No 1, 1880.

natives cost twopence, and Whitstable oysters three-half-pence each in London, the very land of oysters, so scarce had they become. (*g*)

In concluding this chapter, and in connection herewith, I have gathered a few interesting items relating to Poole oysters and insert them as an

ADDENDUM.

Results of dredging on the 11th December, 1889, on Poole Harbour. (The Corporation beds.)

Weather: Sun bright, warm day, slight wind, mud certainly not frosted.

12 hauls from Parkstone Pier to Brownsea Castle.
Time: 1.15 p.m. to 4.30 p.m.,

		Marketable oysters.		Too small and thrown back	
1st haul	..	1 dredge	.. 3	2	2 five-fingers.
2nd	..	..	.. 1	2	1 star-fish.
3rd	..	..	.. 3	4	
4rd	..	..	.. 1	2	2 star-fish.
5th	..	..	.. 1	3	
6th	..	..	.. 0	0	2 boring whelks.
7th	..	..	.. 3	2	
8th	..	..	.. 2	4	
9th	..	..	.. 1	1	1 star-fish—14 fingers.
10th	..	..	.. 1	2	1 boring whelk.
11th	..	..	.. 2	1	
12th	..	..	.. 1	1	2 boring whelks.
Total of 12 hauls		..	19	..	24

Soil: stone; very little cultch; much weed.

(*g*) The Edible Mollusca of Great Britain and Ireland, &c., by M. S. Lovell.

Table showing the number of oysters caught in Poole Harbour by fishermen, to whom licences were granted by the magistrates, in the years 1887, 1888, 1889 and 1890. No record as to number of oysters caught was taken before 1888. 17 licences were granted to the fishermen in 1887, 13 in 1888, none for 1889, and 16 for 1890.

In the year 1888 the 13 licensed men were dredging for 68 days—altogether 424 times, their average catch was 68 oysters per boat. N.B.—These numbers do not include those taken from the beds of the Oyster Company.

Oysters caught January 1888, 21,000; February, 8,400; March, 7,000; April, 2,000; December, 4,200. Total, 42,600

Oysters caught January 1890, 12,030; February, 7,764; March, 2,802; April, 1,050. Total, 23,646.

The reason why so few oysters were taken in 1890 compared with 1888 is because the fishermen had to deliver those smaller than $2\frac{1}{2}$ inches to the water bailiff, whose duty it is to return them, (in that case) to their natural element.

The fishermen in Poole, in common with their class elsewhere, have some very primitive notions concerning oysters. For instance, they fully believe that in its attack upon the oyster, the star-fish awaits the opening of its shell, and then inserts one of its fingers to scoop out the delicious morsel. The attempt to teach them otherwise would but be met with the scorn of happy ignorance.

Another belief to which they cling with unshakeable firmness is, that oysters, like cockles, burrow in the sand or mud; and the reason they give for this, is, that they have collected thousands from off the old discarded beds when only a very small portion of the shell was visible

above the mud. When asked how, and by what means the oyster can burrow? the emphatic reply was—"Well, sir, I don't know—but *they do*."

Again you cannot convince them that five-fingers are not entirely destroyed by being pulled to pieces, before being thrown back into the sea-water. My attempt to teach them otherwise was checked by the jocular remark—"Perhaps it 'uld be better, sir, to throw 'em in our neighbours' backyards for their cats, (to kill 'em, you know,) so as to give us a quiet night after a hard day's work."

I must here trespass on the reader's patience with a momentary digression. In reply to the question—"Does an oyster burrow?" I say, emphatically, no. It has no means of so doing. An oyster is not supplied by nature for such a purpose, namely, with a foot as is the cockle. True, the oyster is often found imbedded in the sand or mud, but, as stated in Chapter 13, this has happened from other causes than that impossible one emanating from the ignorant credulity of the fishermen alluded to, (*h*) say for instance, the iron-jawed and gaping dredge, half gorged with its captured harvest of the sea, sweeping along, and, by its weight and force of progress ploughing up or burying, higgledy-piggledy, the very victims for whose capture it was designed. This is a common cause; but a still more common one arises from the shifting sand and mud, either of which, impelled or drawn by strong under currents

(*h*) And surely all right minded men will endorse my wish that, if ever the ancient town of Poole, like Whitstable, aspires to and becomes possessed of a Museum—no matter how small and insignificant it may be in its beginning—one of its most pleasing and educational treasures may be a working microscope, which, with regard to the oyster, if nothing else, would serve the same purpose as that alluded to concerning the Whitstable dredgers.

from adjacent shores, and rivers, slowly but surely accumulate and destructively cover the dainty molluscs to a greater or less extent. In support of this well known fact, it has been estimated (and this with respect to one river alone) that the amount of sediment carried down annually by the Mississippi to the Gulf of Mexico equals 750,000,000 cubic feet, and this equals a mass 268 feet in height and one square mile at the base. From the knowledge of this fact Geologists have accounted for many fossils which, otherwise, would never have had their history revealed by the pen of Science. Of course, as the deposit of sediment continues, all animals subjected to its destructive influence die, the oyster inclusive; and, in course of time, the whole mass (owing to the commixture of chemical matter) is converted into a different and harder substance.

But, although aware of this cause and effect in the Law of Nature even in his native harbour and the waters in its district—although he will tell you that in certain parts of these waters the accumulation of sand or mud is so dangerously or destructively rapid that within five years the depth thereof has amounted to four or five feet (*i*) still the Pooleite fisher persists in his assertion that oysters *do* burrow in the mud, and in this belief he cannot be shaken.

No argument can alter his opinion, “founded on *fact*.” No truth-rooted, wonder-moving theory of stern, hard-matter-of-fact-Science, can successfully oppose his ignorantly inculcated and obstinate idea. No! nor fossil piles of mud-smothered molluscs (the petrified witnesses to Geological Truth!) can convert this “Toiler of the Sea” from his zoologically-erratic creed. Each and all of these honest labourers, relative to the point in question,

(i) Their statements vary; ranging from 1 foot to 5 feet.

echo the sentiments of a trawler whom I once accompanied in his boat. Politely venturing to question his misguided notion, he looked at me with an amused smile, whilst in an emphatic tone of superior knowledge, tinged with an air of pity at my ignorance, he exclaimed—"I've seen 'em and caught 'em scores o' times. Why, Sir, after the first Oyster Company gave up in Poole Harbour, I've gone down and collected thousands at low water, and some on 'em was quite low down, an' I had to dig 'em up."

I have given the man's assertion verbatim, nor have I stooped to the subterfuge of emphasizing the last words for the purpose of enlarging the importance (as it were) of my own little zoological knowledge, in opposition to the trawler's erratic belief. The words were by no means emphatically intoned, but uttered simply and earnestly, and with a confidence that scorned the very thought of contradiction.

Now what can we say with respect to this state of ignorance?

To use the stereotyped phrase "Comment is needless," were to express a falsification of judgment quite unpardonable and too painfully apparent. I could and would fill pages with "Comment" and suggestions for educational remedies, but I am afraid both would be frustrated in the attainment of their objects. For, putting aside altogether the matter of the mud-burrowing oyster, I ask what hopes of educational success can any writer hope to attain from a necessary and industrial class of individuals, whose thoughtless folly and lack of thrift led them to kill their "goose with the golden eggs." In other words, whose reckless greed tempted them to overdredge the bountiful harvest of their once prolific and

famous oyster beds. *How* famous, the motto to this chapter will give some slight idea ; and just a little while before the writer thereof wrote his highly interesting and instructive little book (27 years since), oysters, dredged in Poole harbour, were so plentiful that they were sold in that town at 9d. per 100. *Now* they are sold at from 1/- to 1/6 per dozen.

Overdredging is a fault (I am almost tempted to say—a social sin) which the fishermen of other places have been and are guilty of, and of which it is grievous to hear ; but the inhabitants of Poole have a double cause for bitter regret, since, with their self-caused diminution of oyster produce, they *feel*—yes, and they *know*,—that had care, judgment, and properly organized and energetic supervision guided their misused oyster industry, they could and would, long since, have rivalled the wonderfully-prosperous and wisely-managed Fishery of Whitstable.

Regret is vain. I can only hope that, since the local beds have been managed by a Company, this once happy certainty may be fulfilled in the near future.

In the Company's efforts I have great confidence, but, so far as regards the "Corporation beds," and the fishermen in particular who dredge thereon (privileged so to do by paying a yearly license of 30/-), I would intimate to all whom it may concern, that, although "the Schoolmaster is abroad," 'twere well for them if the microscope were at home. And this for the same beneficial reasons as those attributed to the dredgers of Whitstable (see Chapter xviii), where, it is but right to admit, the native fishermen have (owing to several advantageous circumstances) somewhat less sad need of it.

The following is a description of samples of oysters sent me by the Poole Oyster Company, January 10th, 1890.

AMERICAN: EAST RIVERS.—Born and bred in America ; fattened in Poole Harbour ; $4\frac{1}{4}$ inches long, $2\frac{1}{4}$ wide. Externally—shape, oblong ; rather rough ; curved from right to left on the flat ; convex shell, corrugated and serrated. Internally, plump and full fish ; drab mantle with darkened fringe ; sepia adductor muscle mark, milky-white shell ; delicious, sharp and pleasant flavour ; hard to open.

ARCACHON.—From Arcachon, and fattened in Poole beds ; 3 inches long, $2\frac{3}{4}$ broad ; externally, a rather thin, smooth shell, inclined to be circular ; convex shell, slightly corrugated. Internally, mother-of-pearl appearance ; full, plump, and juicy ; delicious eating ; sharp to the palate ; drab colour ; white adductor muscle mark.

PORTUGUESE.—Fattened in Poole beds ; length 4 inches ; breadth $2\frac{1}{2}$ inches ; externally—shape oblong ; coarsely rugged-looking ; deep depressions and elevations ; convex shell, much serrated. Internally—very plump, full fish ; drab, with brownish-edged beard ; blue-brown adductor muscle mark ; taste, sweet, fresh, slightly metallic, juicy and rich flavour.

CAEN BAY.—From Caen Bay ; planted in Poole beds ; size, 4 inches long, $4\frac{1}{4}$ broad. Externally—shape circular ; seem composed of very loose, friable layers ; convex shell, serrated and corrugated. Internally—full, plump fish ; white adductor muscle mark ; light coloured mantle ; very delicious, plump, sweet, sharp, appetising ; quite equal in taste to a native ; very hard to open ; powerful hinge.

WEST BAY.—Born and bred in West Bay ; fattened in Poole ; size, $5\frac{1}{4}$ inches long, $4\frac{1}{2}$ broad. Externally—rough, uncouth, friable. Internally—not inviting ; small fish compared with the size of the shell, more fit for sauce than to be eaten ; coarse flavour. Internally

—white adductor muscle mark ; very large drab beard ; difficult to open.

SOLENT.—Same variety as Poole natives ; round shape ; 3 inches by 3 inches. Externally—convex shell, sharply serrated ; thin, flat shell ; assumes pink and bluish tinges when fresh. Internally—very fresh, sweet, sharp, rich, delicate flavoured fish ; drab colour and mantle ; easy to open.

An exceedingly fine specimen of this species (Solent) I bought of a Poole fisherman, the shell of which weighed 1lb. 8½ozs., and the fish 1½ ozs. It measured 6¼ inches in length and 5½ inches in breadth. In spite of its size the taste—perhaps not so sharp, luscious, and tender as a smaller one would be,—was, nevertheless, exceedingly good.

An oyster was dredged off Christchurch which was in length 7in., breadth 7in., circumference 16in., round outside edge 20½in., and in weight 3½lbs.

Wareham River, like that at Whitstable, abounds with Diatoms, which is the reason why oysters planted near it fatten so well ; moreover, the Poole beds are composed of London clay covered with gravel, which is quite sufficient guarantee for the quality of their oysters, which, put in cradles when they are of the size of a shilling, are allowed to attain to that of half-a-crown, when they are removed to fattening beds. The rapidity of growth may be judged from that of a Tagus oyster, 8 inches long, which grew five inches in two years, in these beds.

Pearl oysters, containing small pearls, were found off Old Harry Rocks 30 years ago.

CHAPTER XX.

OYSTER CULTURE IN ENGLAND.

OYSTER FISHERIES (RIVERS BLACKWATER AND ROACH).

RETURN to an Order of the Honourable the House of Commons, dated 9th February, 1870 ; for Copy “ of a REPORT to the Board of Trade by Mr. Pennell, upon the State of the OYSTER FISHERIES in the RIVERS BLACKWATER and ROACH.”

G. SHAW LEFEVRE.

Board of Trade, 9th February, 1870.

REPORT OF MR. PENNELL TO THE BOARD OF TRADE.

Weybridge, 15th December, 1869.

Sir,—I beg to report that, in compliance with your instructions, I have visited and inspected the two recently established Essex Oyster Fisheries, viz., “ The Fish and Oyster Breeding Company,” and “ The Roach River Company ;” the former situated in the estuary of the River Blackwater, and the latter in that of the River Roach.

THE FISH AND OYSTER BREEDING COMPANY.

This Company were amongst the first applicants for the grant of exclusive fishery rights, under "The Oyster and Mussel Fisheries Act, 1866." The Company came into possession of their fishery at the end of May, 1867, having thus been in occupation about a year and a half.

The total extent of the concession was 350 acres, the greater part of which was, for all practical purposes, barren of oysters, the "culsh," or shelly coating of the soil to which the young oysters adhere, being also covered with mud, and overrun with weeds and "vermin." Of this area about 100 acres have now been cleaned and brought under cultivation, including 13 acres of ebb-dry foreshore between low-water mark of neap and low-water mark of spring tides, which was formerly mudbank and entirely sterile. During the summer of 1868, and subsequently, the Company have purchased and laid down stock oysters to the value of £11,631, and these have during the present year borne a crop of spat, with which I found the prepared portions of the ground plentifully covered. Of 56 hauls which I made with the dredge (over various portions of the above ground) in 1867 (before the Company were established) the result was—

Nine brood and spat.

Nine oysters of larger growth.

Of two successive hauls made on the same ground during my recent inspection, the result was—

(1st haul) three brood ; 68 spat.

(2nd haul) 75 spat.

(oysters of larger growth not counted) ; or an increase of brood and spat in the proportion of about 450 to one.

On the public ground below the fishery, about half-a-dozen spat per dredge was the outside average number taken, and these were principally on the north side of the tideway, below where the largest quantity of the Company's oysters are laid.

I found these well flavoured and marketable, though, owing to the earliness of the season, by no means in perfection. I have since had some samples forwarded to me which are equal, in my opinion, to the very best quality of English Natives; in fact, the Company, who at the time of my visit had just commenced marketing their stock, have already disposed of a considerable quantity, at prices which show that they are of an exceedingly good quality.

Thus, in the two cardinal points of breeding and fattening, the capabilities of these previously unproductive grounds have been fully established.

No case of poaching has up to the present time occurred; and the neighbouring dredgermen, who were originally opposed to the concession, are now, I am informed, well satisfied that it has been made, as they find in the Company ready purchasers at their doors for whatever oysters they take on the open grounds. The labour also, and boats hired, have been exclusively taken from amongst the same persons. The fishery appears to have been placed under an able manager, and as on this point depends almost entirely the success or failure of a newly established oyster farm, there is every reason to believe that it will be as advantageous, in a commercial point of view, as it has already been proved to be so far as the interests of the public are concerned.

The following are the items of the Company's expenditure so far as the fishery is concerned, from 30th May, 1868, up to the 4th December instant, and also of the

number of men and boats employed, which show that the Company is proceeding energetically in cultivating the concession which has been made to them; as at the time of my visit the Company had only just commenced marketing their stock, no proper account of receipts could be rendered.

EXPENDITURE.

	£	s.	d.
For Labour	828	2	6
„ Boat Hire	237	17	4
„ Stock Oysters (Native) ..	10,318	4	5½
„ „ „ (Common) ..	1,313	14	4½
	<hr/>		
	£12,697	18	8
	<hr/>		

LABOUR EMPLOYED.

Average number of men employed ..	18
„ „ boats	7

This fishery being the first established under the new system, is one of especial interest; and it is satisfactory to me to find that the anticipations which I entertained as to its capabilities have been borne out by the facts of the case. It will doubtless be equally satisfactory to the Board of Trade, as indicating the success likely to attend the enlightened legislation which they have inaugurated in regard to an important branch of our maritime industry. A further confirmation of such success will be found in the favourable results of the fishery established in the Roach River.

ROACH RIVER COMPANY.

Since the date of my last inspection of this fishery, in June, 1867, the Company have been actively engaged in

bringing fresh portions of the ground under cultivation, and in reclaiming for ostracultural purposes those lying between low-water mark of neap and low-water mark of spring tides. An additional 15 acres of such foreshore have been transformed—by cleaning, laying down culsh, &c.—from mudbank into excellent oyster ground ; making, with the 15 acres of similar foreshore previously reclaimed, and some 270 acres of ordinary sea-bottom, a total of about 300 acres of oyster ground now in cultivation. The area of the entire fishery is about 500 acres.

At the time of my last inspection, no oysters had been actually sent to market, but during the last few weeks the Company have begun supplying them, and the price which the oysters have realised proves the high quality of the fishery as a fattening ground.

Its breeding capacities have also been confirmed in a marked manner by the results of the past season, as will be gathered from the fact that, in a single haul of the dredge, I obtained 100 brood and 153 spat upon ground which, until the establishment of the present Company, was all but barren. On this ground, in 1867, I obtained 148 oysters, brood and spat, in 16 hauls, or about 9 per haul ; in 1864, before the establishment of the Company, 38 oysters were obtained in 150 hauls, or about one in every four hauls. The present produce of the ground, therefore, as compared with 1864, stands in the relation of nearly 1000 to one.

The relations of the Company with the neighbouring dredgermen continue satisfactory, and no prosecution for poaching has up to the present time been instituted.

Since my last visit, the Company have constructed 16 oyster-pits, of about 40 feet by 20 feet, above low-water mark, for storing their produce during winter, and about

80 bushels of brood (last year's spat) are now laid down in these pits.

The following are the principal items of the Company's expenditure, from the 7th of June, 1867, to the 4th of December instant :—

EXPENDITURE.

For Labour	..	..	..	2,283	12	5
„ Boats	..	..	..	813	1	9
„ Culsh, &c.	..	..	..	1,073	19	9
„ Stock Oysters (Native)	..			2,054	9	7
				<hr/>		
				£6,225	3	6
				<hr/>		

LABOUR AND BOATS.

Average number of men employed	.	20
Ditto boats	..	8
(3 boats building.)		

In concluding this Report, I may mention that both in the Roach, Blackwater, and Burnham Rivers, I found the Boat Registry Regulations strictly carried out, and I was informed that the working of this part of "The Sea Fisheries Act, 1868," gave general satisfaction.

I am, &c.,

(Signed) H. CHOLMONDELEY PENNELL.

The Assistant Secretary, Harbour Department,
Board of Trade.

CHAPTER XXI.

OYSTER CULTURE IN ENGLAND, SCOTLAND, AND WALES.

COPY of REPORTS of INSPECTORS appointed in 1876, by the Board of Trade, under the 45th Section of "The Sea Fisheries Act, 1868," to inquire into the State of the Fisheries established under Orders made by the Board, in pursuance of Part III. of the above-named Act.

LIST OF FISHERIES INSPECTED.

BLACKWATER (ESSEX), BOSHAM, BOSTON DEEPS, EMSWORTH, EMSWORTH CHANNEL, FIRTH OF FORTH, BUCCLEUCH (*a*), DONISBRISTLE (*b*), EDINBURGH (*c*), MID-FORTH (*d*), GRESHERNISH, HAMBLE, HOLY LOCH, LANGSTON, LYNN DEEPS, PAGLESHAM, ROACH RIVER, SWANSEA.

BLACKWATER (ESSEX).

BLACKWATER OYSTER FISHERY.

24, *Ladbroke Square, W.*, 20th October, 1876.

Sir,—In compliance with the desire conveyed in your letter of the 31st July last, that I should visit the Black-

water Fishery when in Essex, on the matter of the Shelford Creek Inquiry, I beg to inform you that I visited this fishery on the 24th August, and made a certain number of hauls with the dredge in different parts of it. Owing, however, to the unfavourable state of the tide, and an error as to the place appointed for meeting the manager of the Company, the time at my disposal was exceedingly limited.

On the portions of the fishery, however, where I dredged, I found the ground in a very fair state of cultivation, and marketable oysters laid down. In common, however, with the rest of the Blackwater river, in which nearly every oyster that could be dredged has been carried away, there is little or no spat on the ground, and up to the present moment the company, though supplying the markets with a certain number of oysters commanding a fair price (£9 per bushel), has not been able to pay any dividend to its shareholders. During the past season the sales about balance the expenditure, as will be seen in the annexed return.

The ground seems to be practically in very much the same state of progress and cultivation as when I last reported on it.

Should the Board, however, deem it necessary, I shall be happy to make a further and more complete examination, starting from Maldon instead of Southend, by which means, and a regard to the tides, I should have a longer day and greater facilities for the purpose of inspection.

I have, &c.,

(Signed) H. CHOLMONDELEY PENNELL.

The Assistant Secretary, Harbour Department,
Board of Trade.

RETURN of RECEIPTS, EXPENDITURE, &c., up to 30th April, 1876.*

Date of Order.		Total Number of Acres granted.		Number of Acres at present Cultivated.		Number of Acres at present partially Cultivated as Oyster Grounds.		
1868 - - - -		350		80		200		
Total Sum expended on Fishery in each Year.		Quantity of Oysters Bought in each Year, distinguishing Brood from Marketable Oysters.		Quantity of Oysters Sold in each Year, distinguishing Brood from Marketable Oysters.		Prices Realised.		Total Value of Sales in each Year.
Year.	—	Marketable Oysters.	Brood.	Marketable Oysters.	Brood.	Oysters per Bushel.	Brood. per Wash.	
1868-69 -	£ s. d. 3,468 14 7	Bushels, 148 1,337 C. †	Wash. 477 - 6,084	—	—	£ s. d. — 8 -	—	£ s. d. — 137 12 6
1869 70 -	11,394 3 1	-	-	308½ C. 145 N. 413 C.	-	7 3 3 10 -	-	1,038 17 6
1870-71 -	2,233 10 10	-	488	72 N.	-	6 5 -	-	206 - -
1871-72 -	974 7 1	-	-	347 "	-	6 7 1	-	462 5 7
1872-73 -	451 - 3	-	-	202 "	-	8 10 5	-	2,205 10 -
1873-74 -	440 3 -	-	-	25 "	-	8 -	-	1,722 - -
1874-75 -	353 2 11	-	-	94 "	-	8 17 2	-	200 - -
1875-76 -	438 5 9	-	-	50½ "	-	9 -	-	832 10 -
								454 10 -

* The year is calculated from 30th of April of each year to 29th April of the year following.

† C. Denotes common Oysters; N. Natives.

CAPITAL AND DIVIDEND ACCOUNT.

Amount of Capital.	Amount of Paid-up Capital.	Loans.	Dividends.
£ 50,000	£ 15,500	None.	None.

24, *Ladbroke Square, W.*, 30th November, 1876.

Sir,—I beg to inform you that, with reference to former correspondence and your letter of the 2nd instant, I visited the grounds of the Fish and Oyster Breeding Company, in the Blackwater, on the 23rd instant, and made a further and more complete inspection of the fishery.

The result confirms the view expressed in my former report as to the condition of the ground then dredged, viz., that portion on which the greater part of the company's oysters are laid down for fattening. I found it in a very fair state of cultivation, and stocked with a not inconsiderable number of oysters, ware and half ware, which, upon examination, proved to be "well fished" and in good marketable condition.

On the other parts of the ground, which contain a sprinkling of oysters, the cultivation is only partial; that is to say, whilst the mud which originally covered them has been cleared away, the cultch which remains shows a large admixture of loose stones, which appear to form the natural solum of the channel, and of old shell cultch, which is in itself to a great extent "dead," *i.e.*, presenting that rusty appearance indicating that it no longer forms a favourable resting place for spat. Accordingly, I found no

spat whatever upon it, and only one or two on the "laying" ground before referred to.

In fact, the number of acres (80) which the company claim to have brought under actual cultivation, and to have stocked with oysters, forms such a trifling area in comparison with the surrounding and uncultivated spaces in the estuary of the Blackwater, that this result is not to be wondered at. The tides carry away the spat from the cultivated ground on to grounds either above or below it, where, if it comes to perfection at all, it is lost to the company.

The opposite of this process occurs in the case of rivers like the Roach and the Crouch, and the Burnham river, where the grounds being for practical purposes one entire and cultivated fishery from end to end, the spat carried from one fishery is deposited and brought to maturity on another, the fishery on which they have been actually bred in like manner receiving the spat brought by the tide from the adjacent nurseries.

I have, &c.,

(Signed) H. CHOLMONDELEY PENNELL.

The Assistant Secretary,
Harbour Department, Board of Trade.

BOSHAM FISHERY ORDER.

20, *Onslow Gardens*, 18th January, 1877.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 18th November, 1876, I inspected on the 22nd December the several Oyster and Mussel Fishery granted to the Bosham

Dredgerman's Co-operative Society, under "The Bosham Fishery Order, 1873."

I regret to have to report that the fishery has not increased in productiveness since it fell under the management of the society. When the Order was made in 1873, the ground was almost denuded of oysters ; but Mr. Pennell, in his report made after holding a public inquiry previously to its grant, remarked upon the unusual proportion borne by spat and brood to the number of mature oysters on the beds. It is not improbable that if all the young then upon the ground had been afforded an opportunity of spatting, a marked improvement might already have been visible in the state of the fishery. Unfortunately, about a third of it was destroyed in the winter of the same year by an invasion of sand, which took place in consequence of an alteration, caused by storms, in the bar at the entrance of Chichester Harbour, and by the deposit of large quantities of mud owing to the rupture, on two different occasions, of embankments belonging to large reclamation works by the side of the channel. At the same time the dredgermen, under the pressure of poverty, were unable to exercise sufficient self-denial to maintain the regulations by which they had bound themselves. They have always observed a close time longer than that required by their bye-laws, and fishing has only taken place from November to April ; but the more effective rule, that oysters less than three inches in diameter are to be returned to the water, has been neglected until last year ; so that most of the oysters grown from the plentiful spat of 1873 have been stripped off before they could breed. The number upon the part of the ground which was not destroyed does not now seem to be larger than in 1873, while the quantity of brood and spat is immeasurably smaller. In 1876 the dredgermen,

becoming alarmed at the condition of the fishery, determined upon using, and did in fact use, a $3\frac{1}{4}$ inch ring. They have now further determined not to fish at all during the season of 1876-7; and they are about to endeavour to raise money by an issue of A shares, to enable themselves to partially re-stock the ground. The most fertile part of the beds, amounting perhaps to about a fourth of the area which remains to any degree productive, has been kept in a thoroughly clean state; the remainder is somewhat, though not seriously, dirty. In cleaning their ground the dredgemen suffer from a difficulty which, it is to be feared, must always affect a co-operative society of fishermen, so long as it is not in a highly prosperous state. The individual members are too poor to give the time necessary for working the beds without payment; and the society is too poor to pay for the necessary labour. It may be doubted, indeed, whether the good condition in which the ground now is may not in great part be ascribed to the undue fishing to which it has been exposed.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

BOSTON DEEPS FISHERY ORDER.

20, *Onslow Gardens*, 27th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 1st November, I visited Boston on the 1st and 2nd instant, in order to inspect the oyster and mussel fishery, over which the Cor-

poration of that town possesses regulatory powers under "The Boston Deep-sea Fishery Order, 1870."

Before my arrival, the Corporation gave notice of my visit by advertisement in the local newspaper, and invited any persons having complaints to make with respect to the management of the fishery, to attend a meeting between the Corporation and myself, which I had arranged for the former day. Several dredgers and merchants responded to the invitation, and asserted that the whole of the oyster beds had been closed for three years after the grant of the Order. It was proved, however, by the production of the handbills giving notice of the opening and closing of the various beds, that these assertions were entirely without foundation; and I was assured by the person charged with fixing the handbills, and by the water bailiff, that all notices are posted at the town hall, the market, and other conspicuous places in the town, and that they are also served upon all boats found within the limits of the fishery.* Some complaints were at the same time made against the management of the Lynn beds, which I subsequently found to be equally unwarranted.

From the Report of Mr. Pennell it appears that the beds in 1869 were in a state of almost complete denudation. In five hauls of the dredge he obtained only two oysters, and the evidence given before him seems to have pointed to the existence of "none, or scarcely any." When the Order came into operation, half of the beds

* Mr. Cousens, who in April last gave evidence before the Select Committee on Oyster Fisheries, and who was the chief spokesman of the complainants at Boston, appears to have given his evidence to the Committee under a misapprehension, both as to the facts of management in the fisheries of Boston and Lynn, and as to the productiveness of the oyster fisheries at the date of the respective Orders.

were closed, but in consequence of the complaints of the dredgers, the whole were opened in December, 1872, and have remained open ever since. It was alleged by the dredgers that the beds were being destroyed by not being worked. They now state that, up to the time of the beds being closed, as many as a thousand oysters a day could be obtained from them, and that the operation of the Order has been disastrous. That the beds are now wholly exhausted is unquestionable; but I can attach no importance to the assertions of the dredgers. The part which has always remained open is as bare as that which was closed for two years: the statement that up to the grant of the Order a considerable number of oysters could be dredged is at variance with the facts ascertained by Mr. Pennell; and one of the men who made that statement gave diametrically contrary evidence at the inquiry in 1869. I have before noticed that the fishermen labour under a curious misapprehension as to the action taken by the Corporation, and that they declare the whole beds to have been closed for three years. There can, in fact, be no doubt that the Boston oyster beds were denuded by over-fishing at the time when the Order was granted, and that they have remained in much the same state as that in which they were, except that one of them has been sanded over, owing to a change in the direction of a channel.

As the Corporation have done nothing to stimulate the recovery of the beds beyond closing half of them for two years out of upwards of six for which the Order has been in operation, and as it has never watched them, it cannot be said to have made any serious trial of the powers confided to it; and neglect to carry out the apparent object of a public trust cannot, as a general rule, be lightly regarded. But in the particular case, as all the oyster beds

were in a state of complete exhaustion, and some of them lie close to the mussel scalps, the powers given over them may be taken to have been asked for, and were, I believe, granted rather as a protection against the poaching of mussels than with any hope of renewing their productiveness. Under these circumstances, it does not appear to me that the Corporation, by neglecting the oyster beds, have failed in giving fair effect to the objects of the Order.

EMSWORTH FISHERY ORDER.

20, *Onslow Gardens*, 30th *December*, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 18th November, I visited Emsworth on the 19th instant, in order to inspect the Emsworth Oyster and Mussel Fishery, of which the Oyster Merchants' Company are the undertakers, under "The Emsworth Fishery Order, 1870."

The Merchants' Company appears to have commenced operations in 1870 with considerable energy. During the first year of its existence 374,286 oysters, of which half were full grown, were laid down in the 45 acres of which the fishery consists, and in 1871-2, 90,550, of which half were also full grown, were added to their number. The ground, which had previously been foul and weedy, was cleaned and cultched, and Mr. Pennell reported very favourably in 1871 and 1872 as to the condition and prospects of the fishery. In the course of the latter year, however, the company, from motives of economy, reduced the number of watchers kept by them from four to two, and it

is said that systematic poaching then began and continued with disastrous effects until the end of 1875. Oysters were still laid down, though in diminishing numbers, 77,357 being introduced in 1872-3, and 37,200 in 1873-4. The quantity upon the ground did not increase, in spite of a very good spatting season in 1871, and of the fall of spat every year to a certain amount ; fewer oysters were taken from the fishery than had been imported into it ; no income was derived from it ; and, finally, the company became so discouraged that they reduced their number of watchers to one, and ceased laying down oysters altogether in 1874-5. In my report upon the Emsworth Channel Fishery, to which I may be permitted to refer for the details of the alleged poaching, I state the facts bearing upon it which have come to my knowledge, and express my belief that it did take place to an uncertain though considerable extent. It is impossible to arrive at any definite conclusion as to the degree of influence which it had upon the ill success of the company.

Happily, a reconstitution of the company, and a consequent change of system, which took place in the beginning of the present year, have rendered it unnecessary to determine whether it suffered its losses from causes within or beyond its own control. During the last twelve months 1,600,000 oysters have been laid down in about 25 acres, and are guarded by three barges, which are permanently moored, and occupied by five men. The protected ground is well cleaned. The remainder of the ground is also kept clean, with the exception of the ends which abut on the dredgermen's fishery ; but no oysters have been laid down on it, and for the present it is intended only to leave in it those which are native to the place, and which remain

from the immigrants of past years, and to collect and transfer to the protected part the brood which these may produce.

The concentration of a considerable number of oysters within a small space in the first instance, and the subsequent occupation of an area proportioned to the success obtained, is more likely to offer good results than the more common practice of diffusing oysters over an amount of ground which it is comparatively difficult to keep in the highest condition, and which, perhaps, the number of oysters put upon it is insufficient to hold against the minimum quantity of enemies present in every place. It appears to me, therefore, that the company, under its new management, has been well advised in adopting the method of cultivation with which it has begun, and that if it continues to act with the vigour and caution which now seem to characterise it, there is every reason to expect that it will arrive at permanent success.

The oysters which have been laid down this year are all French. It is, perhaps, worth noting that those from Calvados have not spat at all, that those from Arcachon have spat sparingly, and that those from Brittany have spat freely. If, as is probable, the Breton oysters come from Auray, they have been transferred to a climate and a ground not very different to their own ; while the Arcachon oysters have been exposed to a lower temperature, and those from Calvados have been deposited in ground and at a depth to which they are not accustomed.

In touching upon the subject of spat, I may take the opportunity to remark, that in the returns sent up last spring to the Board of Trade from the various oyster

fisheries established under Orders, the answers given to the question relating to the amount of spat which has fallen in different years were in many cases misleading. Information was asked, not merely as to the number of average or exceptionally good seasons, but also as to the years in which a small quantity only has fallen. When, therefore, a single year is mentioned in the answer, the suggestion is that in no other year has spat adhered, or at least survived. This, however, I do not find to be commonly the fact. At Swansea, where spat is said to have fallen only in 1858, at Lynn, where 1868 alone is mentioned, and in the Emsworth Channel, where 1871 only is specified in the answers of the two companies who have fisheries there, more or less spat undoubtedly falls and survives in every year; and at Bosham the small number of oysters which the channel contains seem to be of every age. On the other hand, the return from Edinburgh is misleading in the contrary direction. Spat has fallen, in the years mentioned in the answer, in fairly stocked parts of the private grounds of the Corporation; but, in the exhausted beds held by it under the Order, as in the other fisheries in the Forth established by Orders, all of which are also exhausted, there is no reason for supposing that any spat survives in most years. Taking as a whole the fisheries which I have inspected, their present condition and their history would seem to point to the conclusion that spat falls every season in greater or less quantity, but always appreciably, until beds are reduced to a certain point of exhaustion; but that when that point is once passed, reproduction becomes at best doubtful. It may be observed that in private grounds, in which, as a rule, more oysters exist than in fisheries established under Orders, the returns sent last spring to the Board of Trade show that in

the larger number of cases spat falls either in every year or at least in most years.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

EMSWORTH CHANNEL FISHERY ORDER.

20, *Onslow Gardens*, 6th January, 1877.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 18th November, 1876, I visited Emsworth on the 20th December, in order to inspect the Emsworth Channel Oyster Fishery, of which the Emsworth Dredgermen's Co-operative Society are the undertakers, under "The Emsworth Channel Fishery Order, 1871."

In 1871, at the date of the public inquiry held by Mr. Pennell previously to the grant of the Order, it appears from the evidence given before him that the fishery which, three years before, was in a very exhausted state, had then still further deteriorated, and that not more than 20 or 25 marketable oysters could be taken in a tide. Mr. Pennell reported that "two things were urgently required to resuscitate the Emsworth fishery, viz. (1), that the ground and cultch should be cleared by being thoroughly worked over with the dredge; and (2), that it should be re-stocked with breeding oysters. If these two things are not done, and the ground left open as at present, I believe that in a few years it will be entirely barren." Although no re-stocking

of the fishery was attempted, the grant of the Order appeared to produce an immediate improvement. The ground was again inspected by Mr. Pennell in 1872, and from the information which he received, he reported that the prospects of the fishery were excellent. In dredging over the beds himself, he obtained in four consecutive trawls with one dredge, 19 marketable oysters and 134 smaller oysters in various stages of growth. The crop also rapidly increased. In 1872-3, 30,210 are returned as having been fished; 95,943 are put down for 1873-4, 310,993 for 1874-5, and 379,744 for 1875-6. From September, 1876, till the end of the year, 77,000 were taken, and from the 1st January to the end of December, 1876, the total number was 108,049. Thus, although the quantity obtained last year indicates a probable falling off from the yield of other seasons, the returns in the whole mark a distinct success. The results of my own observation of the ground, however, hardly coincide with the expectation which might be formed from the figures. Fourteen hauls of the dredge produced only 54 oysters, of which very few were marketable, and the quantity of spat visible was extremely small. None of these casts were made in the portion of the ground nearest to Emsworth, the productiveness of which is said to have been destroyed by some neighbouring reclamation works; and, on the other hand, I was prevented by the roughness of the weather from dredging over one of the banks near the mouth of the channel, which is stated to be the best by the dredgermen. In the part over which I dredged, which forms much the larger portion of the fishery, the ground and cultch are not clean as compared with those of neighbouring fisheries.

I regret that, in order to enable you to form a judgment on the actual condition of the Emsworth Channel

Fishery, I cannot content myself with presenting you with the statements made by the dredgermen side by side with the results of my own inspection; but that I must also place before you a very grave accusation, which is made against them by the Emsworth Merchants' Company, and which if true destroys the value of any inference deducible from the returns supplied by them. It is alleged that systematic poaching was carried on by the members of the Dredgermen's Company upon the Merchants' Company's ground, from 1872 to 1875 inclusively, to such an extent that a very large part of the oysters stated by the dredgermen to have been derived from their own fishery, were in fact taken from that belonging to the Merchants' Company. It is said that in 1871, four watchmen being then kept, little or no poaching occurred, but that in the next year, it being wished to reduce the expenses, the number of watchers was diminished to two, and that poaching then began on a large scale. An attempt was made to check it by prosecuting the offenders, but seven men who were prosecuted in January, 1873, having been discharged on their own recognizances to come up for judgment when called on, the directors looked upon further efforts in this direction as useless, and it is asserted that the poaching steadily increased from that time. A sergeant in the county police, and an ex-constable of that body, who were brought before me, spoke to having seen 20 Emsworth boats dredging upon the Merchants' Company's ground in 1873, and on another occasion, in 1874, they saw 16 or 18 boats engaged in like manner. Mr. Jarman, late secretary of the Merchants' Company, stated to me that he saw 16 boats in one night, and 12 at another time, in 1875. It is alleged that boats frequently came, but that as they chose the night time or foggy mornings it was difficult to count

them, and that even when they were visible it was impossible to identify them, as the numbers on their sails and hulls were smeared over with mud. I informed the dredgermen of the accusation which had been brought against them, and I received from one of the most prominent of them an implied acknowledgment that it is to a certain extent true, in the remark that "there would have been no poaching if the dredgermen had not been "prevented from catching shrimps along shore." It was, however, denied that the poaching was frequent or serious.

The Merchants' Company's fishery forms part of the Ensworth Channel, and is interposed between two portions of the dredgermen's grounds. Before either Order was granted, there is every reason to believe that the two grounds were in an identical condition ; but in 1871, when that now belonging to the dredgermen was still uncultivated, Mr. Pennell reports that the Merchants' Company's ground was cleaned, culched, and ready to receive spat, should any fall. 374,000 oysters, of which half were full grown, had also been laid down ; and in that year the best fall of spat took place which has been known for a considerable time. Nevertheless, while 596,000 oysters were laid down in the Merchants' Company's fishery, from 1870 to 1874, the sale of 510,000 oysters from 1870 to 1875 left it very sparsely tenanted in the beginning of 1876. On the other hand, the dredgermen's ground, into which no oysters were imported until 20,000 were laid down in 1875, is said to have afforded crops which continually increased until 1876, and amounted altogether to 818,890 oysters. Considering the state in which the latter ground was at the date of Mr. Pennell's report of 1871, it is remarkable that so great an increase should have occurred within it, while that belonging to the Merchants' Company, with better chances of

retaining spat from oysters native to it in the exceptionally good spatting season of 1871, and enjoying the advantage of possessing immigrants as well, showed a progressive diminution of its stock. It is also remarkable that in 1876, when the Merchants' Company's ground has been adequately guarded, and when it is not alleged that poaching has occurred, an abrupt drop should have taken place in the yield afforded by the dredgermen's ground to less than one-third, or perhaps to less than one-fourth, of the yield of 1875.

On the whole, I find myself driven to the conclusion that some of the Emsworth dredgermen have poached upon the Merchants' Company's ground to an extent which has not been insignificant; but I am necessarily unable to estimate the degree to which the fact of such poaching invalidates the deductions which would naturally be formed from the returns presented by the Dredgermen's Company.

The only point connected with the working of the fishery which calls for remark is that the Company has abandoned the use of the three-inch ring, by which the oysters which it was permitted to remove were at first tested. All oysters are now brought to a receiver, who judges whether they are fit for market, and rejects those which in his opinion are not fit. It is very probable that some Emsworth oysters grow too rapidly for a three-inch ring to be a sufficient check upon their premature exportation. The practice of judging by quality rather than size is, therefore, a good one, if a sufficiently healthy tone of feeling exists among the body of dredgermen to enable the receiver to act upon his opinion, without reference to the cupidity of individuals.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

FIRTH OF FORTH.

(b) BUCCLEUCH FISHERY ORDER.

20, *Onslow Gardens*, 29th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 1st November, I inspected the Buccleuch Oyster Fishery on the 17th of that month.

It is not altogether clear in what state the oyster fishery was at the date when the Order was granted. For 10 years previously it had been exposed to unrestricted dredging and large quantities of brood had been taken from it by the Newhaven fishermen for exportation to Holland. In all likelihood, its condition was very similar to that of the greater part of the oyster beds in the Forth, which were then described by Mr. Pennell as being semi-exhausted. Considerable quantities of oysters, however, were still being fished. In 1867 the ground was let to Mr. Anderson, who fished it with a steamer in 1869 and 1870, and with 12 smacks, each using four dredges, from that time to 1873. In 1870 he appears to have taken as many as 390,000; but in 1873 the number of oysters upon the ground had so diminished that no regular fishing has taken place from that time, and it is stated that not more than 50,000 in all have since been dredged. It would probably not be unfair to Mr. Anderson to say, that down to 1873, he continued the process of exhaustion to which the ground had before been subjected, and that it was then reduced to an extremely bare state. Subsequently, he has not attempted to work or clean it, but he has laid down 30,000 oysters

from Orkney, Stranraer, and Swansea, in order to ascertain whether any or all of these different kinds will breed in the Forth, and he proposes to import 200,000 or 300,000 if any succeed. At the present time the ground, over the whole of which oysters were formerly distributed in greater or less numbers, appears to be tenanted almost exclusively by clams, and five hauls of the dredge made before me under the superintendence of Mr. Anderson, only produced six oysters and a very few spat, which were all obtained at one cast. If these hauls gave a fair impression of the state of the beds, which, however, Mr. Anderson assures me is not the case, it must be very doubtful whether almost all the ground is not too completely denuded for restoration to be possible, apart from the importation of oysters from elsewhere; and it is evident that the 300,000 oysters which it is proposed to lay down would, if deposited, do little towards restocking so large an area as the 4,700 acres which remain to Mr. Anderson after the relinquishment by him in 1871 of 697 acres, leased in that year from the Duke of Buccleuch by the Corporation of Edinburgh. I cannot therefore look forward under any circumstances to a proximate revival of the productiveness of the fishery; and until a much larger number of oysters are laid down than have as yet been introduced, the only benefit which Mr. Anderson's tenancy can bestow upon it is that, as the ground is withheld from public dredging, the chance is offered that if it continues to be so withheld oysters may in time accumulate afresh.

The portion of the ground leased by the Corporation of Edinburgh is regulated in the same manner as that of which they have obtained a grant from the Board of Trade; I may therefore be permitted to refer to my Report upon that fishery, for a statement of the system upon which their

part of the Buccleuch ground is fished. Its condition is approximately the same as that of the part rented by Mr. Anderson.

In view of the above facts, I have to report that, as the Buccleuch Mussel Order was granted for the purpose of facilitating an increase in the quantity of oysters available for public use, and as the fishery has not been managed in a way calculated to secure that end, the intention of the Order has not been satisfied. At the same time I have to remark that as control cannot be obtained over the oyster fishery, and as circumstances may arise under which the Order would have a useful preservative effect, it does not seem to me that any public advantage would be obtained by rescinding it.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

(b) DONISBRISTLE FISHERY ORDER.

20, Onslow Gardens, 29th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 1st November, directing me to ascertain whether the grantees under the various Orders which have been made by the Board of Trade in pursuance of the Sea Fisheries Act, 1868, are properly cultivating the fisheries established by the Orders, I put myself in communication in the course of the same month with the agents of the Earl of Moray, undertaker of the Donisbristle Fishery, and with Mr. Anderson, who until last

summer held it on lease from him. The information which I gathered from them appeared to me to render any inspection of the ground unnecessary.

The Earl of Moray appears to have applied for the Order with objects wholly foreign to the preservation or cultivation of oysters. On obtaining it he let the ground to Mr. Anderson, fishmonger, of Edinburgh, who took it with the view of being able to protect other oyster grounds also rented by him, and adjoining the Donisbristle Fishery on the south. When the Order was granted a few old oysters existed at two spots within the fishery, but according to Mr. Anderson the ground was not one which would have repaid cultivation, and he never intended to cultivate it. About 10,000 oysters were laid down in 1872, but nothing else appears to have been done to it at any time. It remained unfished on the one hand, but on the other it was never cleaned, and indeed was not touched up to the time when Mr. Anderson, on giving up his tenancy of the adjoining fishery, gave up that of Donisbristle also, because it was no longer of use to him.

Since then the Earl of Moray has taken no measures to secure another tenant, or to cultivate the ground himself; and I am informed by his agents that he is indifferent as to letting it, and that he will not personally undertake its cultivation. I have therefore to report that the Earl of Moray has not properly cultivated the fishery established under the Order granted to him, and that I do not see a reasonable probability of proper cultivation being effected.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

(c) EDINBURGH FISHERY ORDER.

20, *Onslow Gardens*, 29th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 1st November, I inspected on the 20th of that month the Edinburgh several Oyster and Mussel Fishery, granted to the Corporation of that city, under “The Edinburgh Fishery Order, 1870.”

The Edinburgh fishery consists of a long strip of ground, three-and-a-half square miles in extent, lying in the middle of the Firth of Forth, and contiguous to the private oyster fisheries of the Corporation, and of the Duke of Buccleuch. The private beds of the Corporation have been long dredged by the Newhaven fishermen, and at the time when application was made for the Order by the former body, it had agreed to allow the Newhaven men to fish the ground which it was proposed to acquire. As the result of an agreement between various parties, made during the public inquiry for the purpose of establishing convenient boundaries between certain of the fisheries in the Forth, 387 acres of the ground granted by the Order has been let to Mr. Anderson, tenant of the Duke of Buccleuch’s oyster fisheries, and 697 acres belonging to the Duke are rented by the Corporation. The Newhaven fishermen are occupants of the latter ground, and of the remainder of the outer grounds granted to the Corporation under the Order. They are also still tenants of the private grounds of the Corporation. The concentration of

nearly the whole of the fisheries held under different titles by the Corporation of Edinburgh, in the hands of the Newhaven fishermen, has led to the accounts and statistics of the several fisheries being massed together. This is of little importance as regards the accounts, no expense, except the rent payable to the Board of Trade, being incurred by the Corporation in respect of the grounds which are the subject of the Order; but it destroys the value of the return of quantities fished which was sent to the Board of Trade last spring, the numbers given in it being those of oysters taken in the whole of the three grounds.

In spite of the impossibility of arriving at the statistics of production, I can have no hesitation in thinking that the beds granted to the Corporation have deteriorated since the year 1870. From the report made by Mr. Pennell in 1869, it appears that, until a period then "recent," 1500 to 2000 marketable oysters formed an average day's catch in the open grounds of the Forth; in that year 800 was rather above than below the number usually taken: the quantity, according to the fishermen, is now reduced to 150, or 200 at most on the united fisheries; and as only 22 oysters were brought up in three casts of the dredge, made before me in the best part of the only patch of ground conceded by the Order which is now said to contain oysters, I am inclined to think that the above number can only be reached in the private Corporation grounds. For this state of things the responsibility must rest upon the Corporation. The Newhaven fishermen are no doubt bound by agreement to "use the best means of cultivating the oysters," but they have not observed the agreement, and no measures have been taken to enforce it. They fish the grounds without supervision, in whatever manner and to

whatever extent they choose, subject only to the restriction of a close time from May to September. When the oysters are brought into Newhaven, they are tested with a two-inch ring by an inspector appointed by the Corporation, and those which pass through it are replaced on the beds. The restriction is, however, almost, if not wholly valueless. No officer of the Corporation goes upon the beds, and there is consequently no means of ascertaining whether brood and small oysters are taken for sale to the fishing ports on the north side of the Forth. This was done to a large extent in former years ; and if the practice has now ceased, as is supposed to be the case, the reason is to be looked for solely in the scarcity of brood. In itself, moreover, the two-inch test is illusory as a preservative measure. The oysters in the united fisheries generally grow to a size of two inches in two years, and to three inches in twelve months more, before which time they do not spat. With the use of a two-inch ring all such oysters must be taken from the ground before they have had an opportunity of spatting ; and though a certain number of dwarfed oysters exist, which seem to have had their growth stopped by the constant abrasion of their edges in being rolled about on exposed grounds, the proportion which they bear in number to the larger oysters is in no way sufficient to justify any hope that a stock could be kept upon the ground through the spat yielded by them, even if the two-inch ring were not probably, as a matter of fact, small enough to prevent any of them from being returned to the beds. The dwarfed oysters, moreover, occur only in certain places.

The portion of the ground rented by Mr. Anderson has been almost destitute of oysters since a time which seems to be earlier than the date of the Order.

On the foregoing facts I have to report that the Corporation of Edinburgh is not properly cultivating the fishery granted to it under the Order of 1870.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

(d) MID FORTH FISHERY ORDER.

20, *Onslow Gardens*, 29th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 1st November, I inspected on the 17th of that month the Mid Forth several oyster and mussel fishery, granted to Mr. Anderson under “The Mid Forth Fishery Order, 1870.”

Previously to the grant of the various Orders affecting the oyster and mussel beds in the FORTH, the Newhaven fishermen had been in the habit of taking mussels on oyster grounds belonging to the Duke of Buccleuch and the Earl of Morton, and claimed to possess the right of doing so by immemorial usage. It was consequently impossible to protect the oysters, much poaching took place, and mussel fishery orders were applied for in order to obtain the means of effective control. During the public inquiry which followed these applications an arrangement was come to by which the Newhaven fishermen pledged themselves not to dredge or trespass upon the grounds of the Duke of Buccleuch and the Earl of Morton, and as the exterior boundary of their fisheries ran irregularly, the arrangements

took the form of a pledge not to dredge westward of a straight line drawn from Newhaven Pier to Burntisland Harbour. Among other spaces of ground west of this line, but not included in either of the two fisheries above mentioned, was an area of 414 acres, forming part of a larger area over which Mr. Anderson had applied to receive the grant of a several fishery. As the lessee of the Duke of Buccleuch and of Lord Morton's fisheries, Mr. Anderson was the person most immediately interested in the existence of an easily recognized boundary to the western oyster bed; and it was part of the understanding arrived at that Mr. Anderson should withdraw his application for the larger area, and should confine himself to applying for an order over so much ground only as lay westward of the straight line which had been agreed upon. It appears from Mr. Pennell's report that at the date of the public inquiry the ground for which Mr. Anderson thus continued to apply was entirely barren, and that it was useless except for the special purpose of defining a convenient boundary. Mr. Anderson has not attempted to cultivate it, and it remains in the same bare state in which Mr. Pennell describes it as formerly being. The order therefore can make no claim to continued existence, except upon the score of fulfilling its special function. This claim it no longer possesses. Mr. Anderson is not now lessee of Lord Morton's fishery, and the Mid Forth ground projects by its whole length beyond any other ground held by him. At the same time, it is not required for the protection of Lord Morton's fishery, the eastern limit of which lies so nearly along a straight line drawn from Burntisland West Pier to the shore end of Granton West Pier that its recognition on the side covered by the Mid Forth fishery could never present any difficulty.

The Mid Forth Order being useless, and offering no prospect of usefulness in the future, I recommend that it shall be determined.

I have, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

GRESHERNISH FISHERY ORDER.

20, *Onslow Gardens*, 26th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 1st November, I visited Loch Greshernish on the 25th of that month, in order to inspect the several oyster fishery of which Mr. Robertson is the undertaker, under “The Greshernish Fishery Order, 1872.”

I found the ground so choked with seaweed that it was very difficult to form any opinion as to the number of oysters which exist upon it. The quantity brought up by 11 casts of the dredge was only 37, besides 19 brood of 1875, and a very few spat of 1876; but the mass of seaweed was so great that the dredge hardly touched the bottom, and I do not think, therefore, that the results which I obtained give a true impression of the amount which would be taken if the ground were clean. Much of the seaweed had drifted in after gales, but much of it also

grows on the spot, and many of the oysters were attached to it.

It is evident that the ground has not been properly worked. I do not, however, attach blame to Mr. Robertson for the omission. He is entirely ignorant of oyster culture, and applied for the Order, not with a view to profit by a speculation in oyster production, but in order to protect the beds from denudation by the reckless fishing which had for some time previously been carried on. Having obtained the Order, he took the advice of an oyster-culturist, whom he brought to view the ground, as to the methods which he ought to adopt for bringing the beds back to their former state. He was told to give them rest and to lay down cultch, and was not told to clean them. He accordingly left them alone, except that he has put 10 boat-loads of mussel and cockle shells upon them. Although not willing to spend any large sum of money in cultivation, he professes himself anxious to do whatever is necessary to give free scope to the natural capacities of the banks; and he has now undertaken to keep the ground clean, to strew it with more shells, and to collect scattered oysters into the best part of the ground.

On the above facts, I consider that the fishery has not hitherto been properly cultivated, but that there is reason to expect it to be so attended to for the future, that the beds will have the opportunity of recovering themselves if they have not been too much exhausted for recovery to take place without re-stocking. I am also inclined to believe, from the number of oysters stated to be visible at extreme low tides, that exhaustion has not reached the point at which it is improbable that the beds will recover by their own reproductive power.

No sale or removal of oysters has taken place since the grant of the Order.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

HAMBLE FISHERY ORDER.

20, *Onslow Gardens*, 18th January, 1877.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 18th November, 1876, I inspected, on the 15th instant, the several oyster fishery granted to Messrs. Warner and Scovell, under “The Hamble Oyster Fishery Order, 1868.”

The Hamble Fishery consists of 120 acres of ground, which, though nearly barren at the time of the public inquiry held upon the grant of the Order, was then recognised by Mr. Pennell to be eminently fitted, at least in its lower part, both for breeding and fattening oysters. It is not improbable that the ground is not so favourable for breeding as it appeared to be, since the outgoing tide is said to be so strong as to carry much of the spat which is emitted beyond the limits of the fishery to the open beds of the Solent; but as a sufficient supply of cultch did not exist in the channel when it came into the hands of the grantees, and none has since been laid down, no considerable amount of reproduction could, under any circumstances, be expected. A small quantity of spat adhered in 1872, but none has fallen within the ground in any other year. The fishery has been treated as a growing and fattening

ground only. As such it appears to have hitherto been commercially a failure. A mistake seems to have been committed in choosing the part of the ground upon which operations were begun. Of 960,000 oysters which were laid down in 1869 upon the upper portion, a large number were swept away by floods, and those which remained, as well as others imported in successive years, were injured by continual freshets. In 1874 the upper part of the Channel was abandoned, and the attention of the undertakers was concentrated upon the lower ground. Their monetary loss by this time was, however, considerable, and, after laying down 224,000 oysters in that year, and only 90,000 in 1875, they added none in 1876. The cultivated area is now reduced to four acres; the rest of the ground is confessedly neglected, and the total stock of oysters amounts only to about 100,000.

It does not appear to me that, if the fishery remains in the possession of Messrs. Warner & Scovell, any reasonable probability of due cultivation exists. A company is now, however, in process of formation, which intends to take over, amongst other properties, those of Messrs. Warner & Scovell and of the Isle of Wight Oyster Fishery Company. If this company is, in fact, formed, it will supply the Hamble ground with brood from the breeding ponds of the Medina and Newtown rivers, at a cost which it is supposed will be very much less than that at which Messrs. Warner and Scovell have hitherto obtained their oysters, and it is thought also that a great economy will be effected in labour. Under these circumstances, I do not recommend that the Order shall at present be determined.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

HOLY LOCH FISHERY ORDER.

20, *Onslow Gardens*, 16th January, 1877.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 1st November, 1876, I inspected, on the 22nd of that month, the several oyster and mussel fishery undertaken by Mr. Hunter, of Hafton, and established by “The Holy Loch Fishery Order, 1869.”

Although oysters have always existed and still exist in small numbers in Holy Loch, at the date when the Order was granted none appear to have inhabited the ground affected by it. In the year after it came into operation 40,000 were imported from Ireland, and laid down in three different places within the fishery. Many of these seem to have arrived in a dead or dying state, and it is consequently very uncertain with what number of oysters the ground was actually stocked. None of the three spots fixed upon for the formation of beds appear to have been well chosen. One was near the mouth of a river which brings down large quantities of sand, and the oysters placed there were covered up and disappeared. Four or five thousand were laid in shallow water, close to Ardnadam pier; and it is alleged, with much probability, that the surface mud of the bottom was so stirred up by the paddles of the steamers, which call at the pier several times a day, as to choke the oysters: in any case, those laid near the pier never spat, and seem to have gradually died out. A small number were also placed further out, but still possibly within the area of disturbed mud: these have lasted longer, and a few still remain; but as the ground has never been cleansed, it is in a foul condition, and as no cultch has ever been laid down, nothing exists to

which spat could attach itself if produced. The cleansing and cultching of the other beds has been equally neglected.

That Mr. Hunter originally intended to cultivate the fishery seriously seems evident, from the fact that he spent £700 in obtaining the Order, and in the measures at first taken to give effect to it ; but, after the failure of his first experiment, which was made injudiciously, he appears either to have become discouraged, or to have lost all interest in the matter, and from that time the ground has been practically abandoned.

If the original grantee of the Order were still in possession of the fishery, the case would be one in which there could be no doubt as to the propriety of issuing a certificate, under section 45 of the Sea Fisheries Act ; Mr. Hunter, however, died in the course of last year, and his brother, who has succeeded to his property, is contemplating a renewal of cultivation on a larger scale, and in a more sustained manner. The ground is one which seems to be well suited for oysters ; but there is no reason to expect that an oyster fishery will establish itself naturally within it. If, therefore, Mr. Hunter offers good reason for believing that he is likely to stock it properly, and to cultivate it efficiently, I consider that it may be for the public advantage to continue the Order.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

LANGSTON FISHERY ORDER.

20, *Onslow Gardens*, 16th January, 1877.

Sir,—I have the honour to inform you that, in accordance with your instructions dated the 18th November, 1876, I inspected, on the 21st December last, the several oyster fishery granted to the South of England Oyster Company, under “The Langston Fishery Order, 1869.”

The South of England Company hold the portion of Langston Channel granted by the Order, together with the bed and foreshore of parts of two small channels in Chichester Harbour, also affected by the Order, as part only of a large area belonging to them in various places, under different titles, and devoted according to the character of the ground to the several processes of oyster culture. In the ordinary course of their business, oysters, after being bred in the tanks at Hayling, are transferred during the subsequent spring to ponds upon the neighbouring foreshore, whence, in the next season, they are transferred to growing ponds or to the Langston Channel, where they remain until they are ready to be carried to Sharpfleet, to enter upon the final stage of fattening. The Langston Channel is thus looked upon chiefly as a place affording room for the deposit of oysters during a certain stage of growth, and it was with a view to possess a sufficient area for this purpose that the Company applied for their Order. Under these circumstances the ground may be considered to be properly cultivated if it is occupied and is in a fairly clean condition. This may be said to be the case. About 1,700,000 oysters inhabit the middle and lower end. The higher portion is untenanted; but it is said, probably with truth, that the softness of the mud of which its bottom consists renders it unfit for cultivation. The bed of the

cultivated part is free from mud and weed ; but it is infested with a multitude of ascidians, which, though harmless to the oyster upon which they grow, must indirectly be injurious by diminishing the clear space of shell available for the adherence of spat. One small kind in particular frequently covers almost the whole of an oyster or cultch shell with soft red pads. To destroy these, however, would require a large expenditure in labour, and it is at present an open question whether it would be worth while to take the necessary trouble. Although spat is largely produced in the breeding ponds, and from the appearances presented by the oysters in the channel seems also to be emitted there, neither that which may be presumed to escape from the ponds, nor that which is native to the spot, adheres or at least survives. A reason is given for this by the managing director of the South of England Company, the soundness of which it would require continued local observation to test. I am not, therefore, in a position to give any opinion as to its value ; and the fact that the special use of the ground is independent of its success as a breeding bed, makes inquiry into the true cause unnecessary for the objects of my inspection.

Though the company treat the fishery mainly as a growing ground, they are not indifferent to the advantage which would accrue from reproduction taking place upon it. As a rule oysters which are placed in the channel remain there during at least one season after they are of spatting age, and cockle shells are laid down to afford attachment for spat ; 600 bushels were deposited last season.

The channels belonging to the Company on the eastern side of Hayling Island are in part rented from

private owners, and in part held under lease from the Board of Trade. The latter portion remains uncultivated, to some extent apparently because of its nearness to the ground belonging to the Emsworth dredgermen, but mainly, no doubt, because the Company have not hitherto required so large an area as they possess.

I am, &c.,
(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

LYNN DEEPS FISHERY ORDER.

20, *Onslow Gardens*, 28th December, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 1st November, I visited Lynn on the 4th and 5th instant, in order to inspect the oyster and mussel fishery over which the Corporation of that town possess regulatory powers under “The Lynn Deeps Fishery Order, 1872.”

I was unable to examine the oyster beds, the weather being such as to render dredging impossible; and the tides were not low enough to expose the more productive of the mussel scalps. I would prefer to have been able to inspect the oyster beds, but I have not since had any time at my my command during weather in which dredging could be carried on to any useful purpose on such exposed ground; and I believe that the information which I have gathered justifies me in forming an opinion regarding them with some confidence.

The oyster beds lying within the ground affected by the Lynn Deep's Fishery Order are about nine miles in length. Over a third of this area the Corporation can only exercise its powers with the consent of the Corporation of Boston, and the water bailiffs appointed by the two bodies have authority in common within it. The remaining two-thirds are under the control of Lynn alone.

No serious effort has been made to regulate fishing in the ground held in common with the Corporation of Boston. In 1872 a close season was established from the 20th June until the end of August, and in 1873 the bed was closed during July and August; but except at these times it has remained continuously open.

More attention was at first paid to the beds which are under the sole authority of the Lynn Corporation. So soon as the Order came into operation their northern half was closed, and it was kept closed until March, 1875. It was then open for three months, during so much of which time as fishing continued 696,000 oysters were taken, under the superintendence of an officer of the Corporation, who enforced the use of the $2\frac{1}{2}$ -inch ring required by the terms of the Order. The beds had only been opened a fortnight when they were found to have again become exhausted; and they were closed from the end of the three months until further notice. The Corporation have not taken advantage of the power given by the Order to close one-half of the beds during the first three years after the date of the Act confirming it; and the southern half of the beds exclusively belonging to Lynn, forming one-third of the whole, were continuously open, except during the close season of each year. The amount of protection thus afforded to them was quite insufficient to restore the pro-

ductiveness which characterised them 30 years ago, but which they had lost when the Order was granted. They are now in an exhausted state; and the condition of that part of the beds which was fished in 1875 is not only similar, but is likely to remain so. Until after the summer of that year, £30 annually was paid for watching the closed beds to a pilot whose business led him into their neighbourhood, and for some time before they were opened additional payments were made for more constant supervision than had before been given; but since then all special watching has ceased, and they are only visited on the rare occasions when the water bailiff can be spared from the mussel scalps. He appears to have been on the oyster grounds less than ten times in the current year, and it is confessed that they are now practically open. If they are not fished, it is because the dredgermen do not find enough on them to repay their labour.

As the oyster beds within the area affected by the Order are of large size, and were formerly highly productive, the cessation of efficient control over them from the moment at which it was seen that a hope of their recovery might still be entertained, constitutes, *primâ facie*, a neglect to carry into effect the provisions of the Order in respect to one of the two equally important objects contemplated by it; and as the oyster beds are confined to the northern part of the Lynn Deep, and the mussel scalps are equally limited to the southern portion, a failure to carry out the Order is an abandonment of half the ground asked for and conceded. It lies with the Corporation, therefore, to show that no other action than that which they have taken has been open to them. It is alleged on their part that their income is not sufficient to

provide for watching both mussels and oysters; that it is necessary to choose between the two, and that the result of a fair trial which has been given to the former proves the mussel fishery to be the more valuable, and consequently that which it is better to cultivate with their whole resources. They lay stress upon the fact that the oyster beds, after being closed for three years, were exhausted in a single season, as showing that their productiveness for the future must be doubtful; and they point out that the mussel crop has been found to be constant, and that the value of the mussels produced during the three years 1873, 1874, and 1875, is more than double that of the oysters fished upon the preserved beds.

These reasons do not appear to me to be altogether satisfactory. It is true that up to the present time the mussels produced within the fishery have been of more value than the oysters; but mussels spat more regularly than oysters, they breed and are fished at an earlier age, and the results of care are therefore sooner apparent upon mussel scalps than upon oyster beds. In this particular case it is probable that the maximum yield of mussels which can be looked for under the present system of cultivation has already been obtained. On the other hand, the appearances presented by the oyster beds in 1875 were not unfavourable. Young oysters were found in some quantity, spat had fallen in 1873 and 1874, and the water bailiff thinks that if properly looked after the beds would restock themselves. That they were fished out in a fortnight only indicates that they had been previously too much exhausted to bear so long a period of fishing, after the short time which had been given to them for revival, and that care ought to be taken to prevent them from being denuded when opened again at a future time. It can

hardly be said that there was anything at the end of the season of 1875 in the state of the oyster beds, as compared with that of the mussel scalps, to justify in itself an abandonment of the former for the sake of the latter.

No doubt, if the Corporation was destitute of resources for carrying on both fisheries at once, it became necessary to choose between them, and unquestionably the fisheries have not paid their expenses. The deficit upon their account amounted in 1872-73 to £179 16s. 10d.; in 1873-74 to £151 9s. 11d.; in 1874-75 to £151 1s. 11d.; and in 1875-76 to £133 3s. 1d. I am not aware whether the Corporation is in possession of funds sufficiently ample to enable it to meet these expenses without inconvenience. But it must be remarked that the greater part of them, apart from those incidental to the acquisition and maintenance of a fishery of either kind, have been incurred in respect of mussels. In the three years, 1872-73, 1873-74, and 1874-75, the cost of watching the oyster beds, and of some prosecutions, as far as I have been able to ascertain it from the accounts of the Corporation, was £129 17s. 8d. During the same years the like expenses in respect of mussels amounted to £463 18s. 1d. The receipts from licenses were £183 13s. 8d. Of this sum part was paid by oyster dredgers; but assuming the whole to have been received from mussel gatherers, and deducting it from the expenses of the mussel fishery, that fishery will still be found to have cost about £280 more than was received from the licenses.

At the time that application was made for the Lynn Deeps Order, the Boston Order had been in operation for two years; the promoters of the former had, therefore, fair means of estimating the cost of managing their own mussel

fishery by reference to one of identical character, and of nearly the same extent; and as there was nothing in the experience of the Boston Corporation to lead to the belief that the Lynn Mussel Fishery would be self-supporting, the promoters of the latter ought not to have applied for 50 square miles of ground in which no mussels exist, unless they were prepared to meet the cost of its efficient management, after providing for the loss which might be expected to occur upon the mussel account. I can fully appreciate the reasons which may have weighed with the Corporation in inducing them to neglect the oyster beds, when the pressure of expense became inconvenient. The fishermen of Lynn have never been employed in dredging for oysters. At a time when 100 boats were commonly seen upon the Lynn beds, not more than 10 or 12 belonged to Lynn itself; in 1871, out of 125 registered boats, only one was engaged in oyster fishing; and three fishermen formed the contingent which Lynn provided for the dredging of 1875. It was not likely that Lynn would profit to any great extent by the development of its oyster beds; while, on the other hand, the mussel fishery is chiefly in the hands of the local fishermen, and the Corporation might very naturally be unwilling to spend local funds for a non-local object. But considerations of this kind ought to be taken into account before application is made for a regulating Order. A body undertaking to regulate a fishery accepts public property in trust, primarily no doubt to administer it for the sake of the fishermen with whom it is more immediately connected, but under the obligation to so manage it in the interests of the public at large as to secure the largest possible amount of production. A trust so undertaken cannot be laid aside at any moment when the interests, or the convenience, of the trustees may happen to be touched.

With reference to the Lynn Fishery, I have to report:—

That the Corporation is not now properly carrying the Order into effect with respect to the oyster beds.

I am, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

PAGLESHAM OYSTER FISHERY.

24, *Ladbroke Square, W.*, 20th October, 1876.

Sir,—In compliance with the request contained in your letter of the 31st July last, that I should take advantage of my visit to Essex in the matter of the Shelford Creek Fishery Order, to make an inspection of the Paglesham Fishery, with a view to ascertaining whether the ground is being properly cultivated, I visited the fishery on the 22nd August, and after making a careful examination with the dredge, I beg to inform you that I found that the mud, weeds, and “vermin” with which the ground was originally covered have been removed almost over the entire area (four acres), and that clean cultch has been substituted, on which 65 bushels of brood and half-ware oysters, and 15 bushels of full grown oysters, have been laid down as stock.

The result of these measures is now seen in the fact, that wherever the dredge is thrown it brings up hundreds, I might almost say, without exaggeration, thousands of young spat, the majority this season’s produce. I should say that, with a fairly mild winter, there is now a sufficient quantity of brood and spat, the indigenous produce of the

ground, to make at least from two to three hundred bushels of marketable oysters, which at, say £9 a bushel, would realise the sum of £2,700. The total sum expended up to April last on the various items above enumerated, embraced under the general term of "cultivation," as shewn in the tabulated return annexed, labour and boat hire inclusive, amounts to £1,121 6s. 5d., thus leaving, it will be seen, a large margin for profit, even on the very moderate estimate given above, and in which the purchased oysters and brood are, of course, not included. No difficulty has been experienced in preserving and protecting the oyster grounds, and no prosecution for trespass or theft has been instituted.

When the barren and utterly useless condition of this ground, at the time of the grant of the Order (described in my former report), is borne in mind, I think it must be considered that the foregoing facts exhibit a state of things in every way highly satisfactory, and show not only that Mr. Smith has acted up to his engagements as to the cultivation of the ground, but that the intentions of the Legislature, and the views of the Board of Trade, in granting the Order, have been fully realised.

I have, &c.,

(Signed) H. CHOLMONDELEY PENNELL.

The Assistant Secretary,
Harbour Department, Board of Trade.

RETURN of RECEIPTS, EXPENDITURE, &c., up to 30th April, 1876.

Date of Order granting Fishery.	Total Number of Acres Granted.	Number of Acres at present cultivated as Oyster Ground.	Number of Acres at present partially cultivated as Oyster Ground.	Total Sum expended on Fishery in each Year.	Quantity of Oysters bought in each Year, distinguishing Brood from Marketable Oysters.
1874 - - -	4	4	- - -	{ 1874-75 : £ s. d. 369 - - { 1875-76 : 752 6 5	Oysters - 15 bushels. Brood - 65 bushels.

ROACH RIVER FISHERY.

24, *Ladbroke Square, W.*, 20th October, 1876.

Sir,—I beg to inform you that, in compliance with your desire, I availed myself of the opportunity afforded by the recent Board of Trade inquiry at Southend, Essex, to visit and inspect the grounds of the Roach River Oyster Fishery Company in that county.

Since the company was established in 1866, I have made several visits of inspection, and on each occasion have found an improvement and enlarged area of cultivation, and during the last few years a large and steady increase in the production of the fishery, as evidenced by the quantity of oysters it has been able to send to market. The expenses, on the contrary, have rather diminished than otherwise. It will be seen from the annexed return that, in the year 1872, the number of bushels of oysters sold was only 71; in 1873 it rose to 420; in 1874 to 654; in 1875 to 862, and for the first half year only of 1876, up to 30th June last (the date of the return), to 601 bushels, realising £5,834 7s. 3d., or about £9 14s. per bushel.

These increased sales have produced their natural result on the dividend paid by the company. These were respectively—

	£	
In 1874	2,500 (equal to about 10 per cent.)	} on the called up capital.
In 1875	5,000 („ „ 20 „)	
In 1876	6,250 (or nearly 25 per cent.)	

Of the total area of 403 acres of sea-bed and foreshore originally granted, 306 acres have been entirely and 97

acres partially brought under cultivation, at an expenditure averaging, since the commencement of the work, about £2,700 per annum. One considerable item of annual expenditure is the cost of "cultch," of which 18,000 bushels, principally oyster shells, and 1,200 bushels of cockle shells, were laid down on the company's grounds in the twelve months ending June last. The cockle shell cultch, which is naturally exceedingly light, is laid down as a sort of finish over the heavier shells just when the spat is anticipated.

In common with all the fisheries in the Burnham and Roach and Crouch rivers, the fishery shows a very heavy crop of spat, as many as 20, 40, and even 70 or 80 on a single shell not being at all uncommon. Out of 30 shells which I picked at random from the contents of one dredge, 29 had more or less spat on them, the largest number which I counted upon one shell being 52. I send herewith a few specimen shells, taken from this and the Peglesham fishery, showing the spat as it appears on the cultch.

In connection with this subject it is a circumstance worthy of remark, as bearing on the question of oyster fishery decline and cultivation, that these rivers—the Roach, the Crouch, and the Burnham river, where, as stated, I found everywhere evidence of an abundant fall of spat—are almost entirely cultivated as private fisheries, and are throughout well stocked with parent oysters; whilst on the neighbouring formerly celebrated breeding beds of the Blackwater, which is almost wholly an open public river, and reduced to the verge of extinction by over-dredging, there is hardly any spat whatever.

I am of opinion that the Roach River Company are doing all that, under present circumstances, they can prudently do to cultivate and develop this fishery ; and further, that there is every reason to anticipate its gradually becoming a most important source of supply for the oyster markets.

I have, &c.,

(Signed) H. CHOLMONDELEY PENNELL.

The Assistant Secretary,
Harbour Department, Board of Trade.

RETURN of CAPITAL, RECEIPTS, EXPENDITURE, &c., up to 30th June, 1876.

Date of Order granting Fishery.	Total Number of Acres granted.	Number of Acres at present cultivated as Oyster Ground.	Number of Acres at present partially cultivated.
18 June, 1866 - -	403	306	97

Amount of Nominal Capital.	Amount of Capital paid up.	Loans.	Dividends paid in each Year.	
£ 50,000	£ 25,500	- none - -	<div> <div>1874</div> <div>1875</div> <div>1876</div> </div>	<div> <div>£</div> <div>- 2,500</div> <div>- 5,000</div> <div>- 6,250</div> </div>
				<div> <div>s.</div> <div>-</div> <div>-</div> <div>-</div> </div>
				<div> <div>d.</div> <div>-</div> <div>-</div> <div>-</div> </div>

RETURN of CAPITAL, RECEIPTS, EXPENDITURE, &c., up to 30th June, 1876.

Total Sum Expended on Fishery in each Year.		Quantity of Oysters Bought each Year.		Quantity of Oysters Sold each Year.		Price realised.		Total Value of Sales in each Year.
		Marketable Oysters.	Brood.	Marketable Oysters.	Brood.	Oysters per Bushel.	Brood per Wash.	
	£ s. d.					£ s. d.		£ s. d.
From 10 June 1866 to	2,279 7 9	-	149	—	-	—	-	—
30 June 1867.								
To 30 " 1868	3,318 3 5	-	190	—	-	—	-	—
31 Dec. 1869	3,820 17 4	-	148	143	-	7 2	-	1,016 3 -
31 " 1870	2,162 9 9	-	-	10	-	8 2	-	81 - -
31 " 1871	2,654 8 7	—	-	—	-	—	-	—
31 " 1872	2,309 15 6	-	-	71	-	7 3	-	514 - 7
31 " 1873	2,475 9 8	-	-	420	-	8 12	-	3,618 2 5
31 " 1874	2,411 12 6	-	-	654	-	8 3	-	5,354 12 11
31 " 1875	2,479 19 10	-	-	862	-	9 12	-	8,299 15 8
30 June 1876	1,819 5 7	-	-	601	-	9 14	-	5,834 7 3
TOTAL - £	25,731 9 11	-	-	2,761	-	-	-	24,718 1 10

SWANSEA FISHERY ORDER.

20, *Onslow Gardens*, 26th *December*, 1876.

Sir,—I have the honour to inform you that, in accordance with your instructions, dated the 18th November, I visited Swansea on the 15th and 16th instant, in order to inspect the oyster and mussel fishery over which the Corporation of that town possesses regulating powers under “The Swansea Fishery Order, 1871.” I was unfortunately prevented by boisterous weather from dredging over the ground, but I obtained sufficient information from the town clerk of the borough, from the fishery inspector, and from several dredgers, to justify me in forming an opinion upon the state of the fishery, and upon the manner in which the provisions of the Order have been carried out.

I regret to have to report that the diminution in the produce of the oyster fishery, which gradually took place during the twelve years preceding the grant of the Order, has not been arrested under the regulating powers conferred by it. During the inquiry in 1870, it was stated that the 180 boats then engaged in dredging could each take from 700 to 800 oysters per day. In 1875-6, 110 boats could only take about 350 each in December, and not more than 150 each in the end of February. According to these figures the yield of oysters would seem to have diminished at least 75 per cent. in six years; and startling as this decrease is, the fact of its occurrence is confirmed by the returns sent in April last by the Corporation of Swansea to the Board of Trade. These show that while the gross take of oysters amounted to 9,050,000 in 1873, it sank to 6,600,000 in 1874, and to 3,810,000 in 1875. As brood

was to a certain extent exported before 1871, the prohibition to remove oysters under a certain size imposed by the Order has, no doubt, had some effect in limiting the quantity taken as compared with that fished before 1871, but the progressive decline which is apparent in the fishery from year to year must, of course, be wholly independent of it. Nor can the diminution be attributed to absence of spat. It is true that no very large quantity has been observed for many years, but I was informed that a certain amount in every season attaches itself and survives; and that this is the case I am satisfied from personal examination of a large number of oysters of various ages in the storing beds at Oyster-mouth. At the time of my visit the greater part of these were young. The only remaining cause to which a diminished yield can be ascribed is undue dredging, and there can be no doubt that the continued deterioration of the fishery is not less owing to this than was its original impoverishment. It may, in fact, be said that the dredging which is now carried on within the provisions of the Order is, for all practical purposes, as wasteful as the unregulated dredging which devastated the beds before the Order was granted. That this is the case is due partly to the smallness of the ring, the employment of which is prescribed by the Order, and partly to the abstinence of the Corporation from using its power to close a portion of the beds.

A regulation preventing oysters from being taken which cannot pass through a ring of a certain diameter acts to the advantage of a fishery in two ways. It secures that instead of being exported as brood, they shall attain a growth at which they are relatively valuable, and at which consequently a given number brings in a larger return to the dredgermen; and, if the specified size is large

enough, it also secures that oysters shall not be removed till after they have had an opportunity of spatting. It may be suspected that the opinion of dredgers and merchants as to the limit of size best suited to a particular fishery is often dictated by too exclusive attention to the first of these effects, which may be fully produced before the oyster has arrived at the usual spatting age ; but it is evident that, from the point of view of the public interests, it is immaterial in what proportion the price of an oyster is shared between the different persons concerned in its breeding, growing, fattening, and placing in the market. It is essential only that as many as possible shall be reared ; such preservative measures ought, therefore, to be taken as are calculated to guarantee the existence until after the age at which breeding takes place of the largest possible proportion of young produced at a given time, if the ground is not at that time sufficiently stocked, or if it is sufficiently stocked, of enough young to maintain the number of oysters at its actual level. Judged by this rule, the limit of size fixed in the Swansea Order is clearly inadequate. On the Swansea ground oysters are large and of quick growth. At four years old their average diameter is about four inches ; at three years old, when, according to the dredgers, they begin to spat, their breadth approaches three inches ; and in the autumn after they reach an age of two years, they will not pass through a 2-inch ring ; indeed I saw some specimens about a year-and-a-half old which measured $2\frac{1}{2}$ inches. In the common course of trade, oysters of all sizes are dredged in the autumn by the fishermen, and are sold to merchants, who place them in storing beds made upon the foreshore. There they remain till the spring, when they are for the most part bought by London merchants to be

laid down in the Thames for fattening; those which are not then removed are kept till the summer months, when they are sold for consumption. In both cases they are exported before they have had an opportunity of spatting; and, as under the influence of continual fishing, full-grown oysters are necessarily diminishing each year upon the ground where the dredge can be used, reproduction may be said to depend almost solely upon such as are protected by the boulders and large stones with which parts of the beds are strewed. The 2-inch ring, therefore, while sufficient to retain oysters on the ground until they are commercially of a convenient age, is useless for the preservative objects to secure which the Order was granted.

It appears from the report made by Mr. Pennell in 1870, on the occasion of the public inquiry held prior to the grant of the Order, that the dredgers were then almost unanimous in advocating the concession of power to close portions of the ground from time to time, and power to close one-third of it for not more than two years was accordingly granted to the Corporation. Unfortunately the good sense of the fishermen was unable to hold out in face of a constantly diminishing crop; and the facts which ought to have constituted a reason for using the powers of the Order to the full, supplied an excuse for this neglect. In 1873 the Corporation proposed to close the grounds within Swansea Bay for two years, but a petition was at once presented by a majority of the dredgers, representing that as the banks which it was intended to close formed the only beds which could be fished in rough weather, the fishermen would be starved if the prohibition were carried out, and praying that dredging might be allowed during the months of December, January, and February. The petition was acceded to, with the result that the dredgers

confined themselves to the Swansea Bay ground during the earlier part of the winter months of 1873-74 and 1874-75, and so exhausted it that they shifted over to other beds before the end of February, because dredging had ceased to be profitable upon it. The closing of a part of the ground has, therefore, been merely nominal. It is much to be regretted that a fair trial has not been given to the system of making reserves. It has already been mentioned that a certain amount of spat falls every year, and as the Swansea ground is not one which requires to be cleaned, and the enemies of the oyster do not appear to exist upon it in excessive number, the conditions of reproduction are unusually favourable. It seems probable that, if a good stock of breeding oysters had been allowed to collect, a very considerable increase might take place upon the bay beds, and it is even likely that they would serve as a centre of reproduction, not only for the whole Swansea fishery, but even for places beyond its limits. I am informed that, in the opinion of the fishermen, the coast for some distance used to be supplied with spat from the bay; and it is stated that while the grounds lying outside it are much disturbed in rough weather, those within the heads are protected, and that the tides set strongly out of the bay so as to distribute spat widely up and down the coast.

In the draft order originally proposed by the Corporation, power was given to levy a license duty of 3s. for every registered ton which boats engaged in the fishery should be capable of carrying. The dredgermen objected to the amount of the toll, and consequently, although anxious for a regulating Order, they appeared at the inquiry to oppose that promoted by the Corporation. On it being explained that, from the extent of the ground, a staff of at least three water bailiffs would be required, and that a lighter

toll would produce an insufficient income, the fishermen offered, if the duty were provisionally reduced to 1s. per ton, to furnish from amongst their own body 12 water bailiffs, to be approved of by the Corporation, together with the requisite boats. The offer was accepted, and the Order, as ultimately framed, fixed a toll of 1s. per ton in the first instance, power being reserved to the Corporation to increase the amount, with the sanction of the Board of Trade. The arrangement, however, by which this low toll was justified, at once fell through. The dredgermen acting as water bailiffs exercised no control over their fellows, and it is even stated that they were the first to infringe the rules which it was their duty to enforce. In 1873, therefore, a paid inspector was appointed, but he remained without a boat until the present year; he now has one which is unfit for use upon the outer grounds, and he is entirely without assistance. The inspector being thus crippled by deficient means, his supervision of the beds, which are scattered over 100 square miles, is necessarily imperfect; but the income derived from licenses is not enough to enable the Corporation to provide more effective control, and they have not chosen to attempt to use the power of increasing the tolls reserved to them under the Order; indeed, with a declining fishery and growing poverty among the dredgermen, it is obvious that there might be great difficulty in raising the price of licenses, and that under such circumstances it would have been much easier to continue a higher toll if it had been so fixed originally.

The fishery is worked at a loss. Its cost is £75 per annum; and the income, which in 1873 was £80, had declined in 1875 to £40, and is estimated for the current year at £50. This state of things forcibly directs attention to a serious difficulty which affects the proper working of

regulating Orders. While the fishery is in an unproductive condition, and at the time, therefore, when it requires the closest supervision, and in some cases a considerable expenditure of money, the income derived from it is necessarily small. Some Corporations do not possess the means of supplementing the income afforded by tolls from other sources ; and those who have money which can be used for the purpose may not always be willing to devote it to the protection or development of their fishery. There is always, therefore, much risk that a regulating Order may fail to produce its proper effects for want of adequate pecuniary means. I may perhaps be allowed to suggest that in future cases of applications for such an Order it might be wise, before granting it, to require some guarantee that if the necessary expenditure is not covered by the income of the fishery, it will be met from other resources.

I have, &c.,

(Signed) W. E. HALL.

The Assistant Secretary,
Harbour Department, Board of Trade.

NOTE.—The Menai Straits Fishery Order, 1874, was determined by a certificate issued on the 21st July, 1876, by the Board of Trade, under the 45th section of “ The Sea Fisheries Act, 1868 ; ” and the Salcombe River Fishery Order, 1872, was determined by a similar certificate issued on the 1st August, 1876.

CHAPTER XXII.

OYSTER CULTURE IN ENGLAND.

HERNE BAY OYSTER FISHERY.

RETURN to an Order of the Honourable the House of Commons, dated 7th February, 1882; for Copy “of REPORT by Mr. Spencer Walpole of an Inquiry held by him at Herne Bay, by Order of the Board of Trade, under the Provisions of the Sea Fisheries Acts, to inquire into the manner in which the Herne Bay, Hampton, and Reculver Oyster Fishery Company are cultivating the Oyster Grounds within the limits of that portion of the Fishery granted to them by ‘The Herne Bay Fishery Act, 1864,’ which remained vested in them in July, 1881.”

T. H. FARRER.

Board of Trade, 7th February, 1882.

REPORT OF INSPECTOR.

Home Office, 24th August, 1881.

Sir,—I have the honour to inform you that, in obedience to the instructions of the Board of Trade, which were

communicated to me in your letter of the 13th ultimo, I held an inquiry at Herne Bay on Monday, the 8th instant, into the condition of the oyster-grounds of the Herne Bay, Hampton, and Reculver Oyster Fishery Company.

In accordance with the provisions of the 32nd section of the Sea Fisheries Act, 1868, and with the directions which I received from you, notice of my inquiry was published "fourteen days at least before the holding thereof," in the *Times*, the *London Shipping and Mercantile Gazette*, and in the *Whitstable Times*.

Copies of the newspapers in which the advertisements thus appeared are attached to this Report.

Notice of my inquiry was also forwarded to the Company, to the representatives of the Memorialists, and to the Collector of Customs at Faversham. Copies of the notice were also publicly "posted" at Faversham, Whitstable, and Herne Bay. A copy of the notice which was thus posted is attached to this Report.

As the inquiry had not terminated at the conclusion of my sitting, on the 8th of August, I adjourned it till the 9th of August; and as the evidence was not concluded at the end of the second day's sitting, I again adjourned the inquiry to the earliest day on which it was convenient for all the parties before me to attend, viz., Saturday, the 13th of August.

I remained myself at Herne Bay on the morning of Wednesday, the 10th of August, for the purpose of dredging over the company's grounds. I was prevented doing so by the weather. I returned to Herne Bay on the evening of the 11th of August, for the purpose of dredging on the morning of Friday, the 12th of August. But, though I was on board for some time making the attempt, I was again prevented by the weather. I therefore decided

on making a renewed attempt at daybreak on the 13th of August, and succeeded in having four hours' work (from 5 a.m. to 9 a.m.) before my formal sitting at 10 a.m.

I was accompanied on the occasion by representatives both of the Company and of the Memorialists; and my thanks are due to these gentlemen for the ready manner in which, at some inconvenience to themselves, they attended on all the occasions referred to.

The Company, I ought to add, was represented at my inquiry by Mr. Ewins Bennett, who, instructed by Mr. Jordan (Messrs. Marriott and Jordan), conducted their case. The case of the Memorialists was conducted by Mr. Fielding (Messrs. Plummer and Fielding). I am indebted to these gentlemen for the assistance which they rendered to me.

I am now in a position to make the following Report:

The Herne Bay, Hampton, and Reculver Oyster Fishery Company was incorporated by a private Act, passed in 1864, the 27 and 28 Vict., cap. cclxxx.

The Company was incorporated for the purpose of maintaining an oyster fishery, oyster beds, and other works in the estuary of the river Thames, on the north coast of Kent, near Herne Bay.

The capital of the Company was fixed at £100,000, in 10,000 shares of £10 each, and the Company was also authorised to borrow on mortgage, for the purposes of their undertaking, a further sum of £25,000.

The object of Parliament in incorporating the Company is clearly stated in the preamble of the Act:—
“Whereas the making and maintaining of a duly protected oyster fishery in the estuary of the river Thames, with proper and sufficient oyster beds, and other works and conveniences connected therewith, would tend to

increase the supply of oysters, and would be of public advantage ;” and this object is equally clearly shown by the 32nd section of the Act, which provides that—

1. In the event of the Company failing to proceed with the execution of the works by this Act authorised, within one year after the passing of this Act ;

2. In the event of the Company failing to prosecute and complete such works within the time limited by this Act ;

3. In the event of the Inspectors of Fisheries, from time to time acting under the Salmon Fishery Act, 1861, certifying—

(*a*). That the Company has, for the space of twelve months, failed to maintain and cultivate the oyster grounds by this Act defined ; or

(*b*). That the Company has, for the space of five years from the passing of this Act, failed to produce on the said grounds well-fed oysters fit for the public market, so as to be of public advantage,

all the rights, powers, and authorities conferred upon the Company by this Act shall thenceforth cease and determine, and all the provisions in this Act relating to the oyster grounds shall cease to be applicable, as though this Act had not passed.

In the years immediately preceding 1874, and in 1874, memorials were presented to the Home Office, alleging that the Herne Bay, Hampton, and Reculver Oyster Fishery Company had failed to fulfil the conditions under which its incorporation had been sanctioned by Parliament.

One of the then Inspectors of Fisheries, the late Mr. Frank Buckland, had been connected with the Company

as a director. The Secretary of State directed me, as the other Inspector, to inquire into the truth of the allegations contained in the Memorials.

It was not contended at my inquiry that the Company had failed—

1. To proceed with the works which they were authorised to execute within one year after the passing of the Act; or

2. To complete the works in question within the time appointed by the Act.

Of the other two conditions thrown on the Company by their Act, I concluded that—

1. Within five years from the passing of the Act, the Company had produced well-fed oysters, so as to be of public advantage.

2. During the twelve months ending the 31st of May, 1874, the Company had failed to cultivate the grounds.

It seemed to me, however, that the failure of the Company to cultivate the grounds had been due rather to a want of means than of will; that, in other words, the Company was rather unfortunate than in fault. It seemed to me also that they had directed their chief efforts to the cultivation of the western half of the ground, and that they had neglected especially the eastern half.

In consequence, I suggested to the representatives of the Company, and of the Memorialists, that they should agree upon a division of the ground between the Company and the public. I ultimately explained the division which, it seemed to me, could be most fairly and conveniently made.

The Secretary of State for the Home Department was pleased to approve my recommendation; the Board of Trade, to whom the matter was referred, concurred with the Secretary of State. As, however, the Herne Bay Fishery Act, 1864, contained no provision for withdrawing only a portion of the ground from the Company, a Bill was introduced into Parliament which enabled my recommendation to be carried out.

The Bill, which became the Sea Fisheries Act, 1875, placed under the Board of Trade any oyster fishery company which, by any personal or local Act passed since the year 1863, is in any manner made subject to the control of the Inspectors of Fisheries, as if such company had obtained an order under Part III. of the Sea Fisheries Act, 1868.

The 45th section of the Sea Fisheries Act, 1868, as amended by the 2nd section of the Oyster and Mussel Fisheries Confirmation Act, 1869 (No. 2), enacts that a right of several oyster fishery, conferred by an order of the Board of Trade, shall be determinable either as to the entire area of the fishery, or as to any part thereof, by a certificate of the Board of Trade, certifying to the effect that the Board of Trade is not satisfied that the grantees under the order are properly cultivating the oyster grounds within the limits of such fishery.

The passage of the Sea Fisheries Act, 1875, therefore, transferred to the Board of Trade the jurisdiction which the Inspector of Fisheries had been given over the company. Soon after its passage fresh Memorials were presented to the Board of Trade, alleging the non-cultivation of the Company's grounds. The Board of Trade instructed me to act as its Inspector, under the Sea Fisheries Act, 1868, and to inquire into the truth of these allegations. Accordingly, at the end of 1875 and in the beginning of

1876, I held a fresh inquiry into the matter at Herne Bay. I found as a fact that the Company, since the conclusion of the period which had been the subject of my previous inquiry, had not been properly cultivating the oyster grounds, and I recommended the Board of Trade * to divide the grounds between the Company and the public in the manner which I had proposed in my previous Report.

The Board of Trade approved the recommendation which I thus made, and on the 8th of November, 1876, issued a certificate reducing the Company's grounds to the suggested limits.

This decision practically reduced the area of the company's grounds from about nine square miles to rather more than four square miles.

I have traced the past history of the Company thus shortly, because it may illustrate my future remarks, and make them more intelligible than they might otherwise prove to persons to whom this Report may be ultimately accessible, and who may not be so well acquainted as the Board of Trade itself is with the Company's history.

I now proceed to state the circumstances under which the present inquiry arose.

In the summer of 1880 three Memorials were presented to the Board of Trade from the Company of Free-fishers and Dredgers of Whitstable, from the Company or Fraternity of Free Fishermen and Dredgermen of the Manor or Hundred of Faversham, and from fishermen and others connected with the parish of Whitstable and the neighbourhood, with reference to the manner in which the Company was cultivating its grounds.

* Mr. Walpole's Report was presented to Parliament in 1876, and is contained in Parliamentary Paper No. 65 of Session 1876.

These Memorials are not identical. But they all practically pray the Board of Trade to order an inquiry for the purpose of ascertaining whether a certificate should not be issued that the Herne Bay, Hampton, and Reculver Oyster Fishery Company is not properly cultivating the grounds to which the fishery had been reduced in 1876.

These Memorials—which were, I believe, received at the Board of Trade in June and July, 1880—accompanied your letter of the 13th ultimo, instructing me to inquire into the condition of the fishery. They are herewith returned.

At the opening of my inquiry at Herne Bay, a counter memorial was presented to me through Mr. Bennett, from the inhabitants of Herne Bay, Whitstable, and the neighbourhood, praying that “no recommendation or certificate may issue having the effect of annulling or curtailing the rights of the Herne Bay Oyster Fishery Company.” The memorial is addressed to the President of the Board of Trade; it ought, strictly speaking, to have been presented to the Board; but Mr. Bennett, to whom I pointed out this circumstance, asked me to take charge of it, and submit it to the Board. I accordingly annex it to this Report.

Mr. Bennett, after presenting this memorial, contended that the proper cultivation of the fishery, under the 45th section of the Sea Fisheries Act, 1868, must be the cultivation of the fishery contemplated by the 32nd section of the Herne Bay Act, 1864; in other words, must be cultivation for the twelve months preceding my inquiry. Mr. Fielding, on the other hand, insisted that cultivation was necessarily a continuing act, and that he was entitled to trace the history of the Company, at any rate, from the date of my preceding inquiry. I declined to take upon

myself the responsibility of excluding this evidence, and I pointed out to Mr. Bennett that it would be obviously impracticable to limit the inquiry to the extent which he proposed, as the memorialists were evidently entitled to go into the twelve months preceding the presentation of their memorials, or the twelve months ending May, 1880. Mr. Bennett admitted the force of this conclusion, and modified his objection to my receiving evidence on matters preceding the 1st of June, 1879. At his request I noted his objection, and promised to mention it in my Report.

In redeeming my promise, I venture to add that, if I had limited the inquiry in the manner which Mr. Bennett desired, I should have found myself with little or nothing to inquire into. During most of the year, which ended on the 31st of May, 1880, the Herne Bay Company can hardly be said to have had an organised existence, and I think it will appear from what follows that the Company's case during those twelve months was weaker than at any previous period.

I have explained in such detail, in my previous Reports, the process of oyster culture, that I do not desire to dwell on this matter at any length now.

It is sufficient for my present purposes to say that oysters "spat" in the summer months; that the spat, extruded from the parent shell, float, or rise and fall in the water, till they find some clean hard substance to adhere to; and that all oyster culturists admit the necessity of providing a clean bottom, or other surface, for the purpose of encouraging the attachment of the spat.

This object may be obtained in two ways: 1. By placing clean oyster, mussel, or other shells on the grounds for the spat to adhere to. Shells so placed are technically called "cultch;" and 2. By dredging over the ground, and

thus removing, to some extent at any rate, the weed, ross (or matter accumulated by a tube-inhabiting annelid, the sabella), and other matter injurious to the oyster.

Dredging is also of importance, because by this means the enemies of the oyster—the principal of these are the fivefinger (the common star-fish of the sea-shore), and the dog, or rough, whelk—are taken, and may be destroyed.

Up to the date of my last inquiry, the Company had regularly dredged over the ground in the spring or early summer of each year. In 1872, they had 35 boats so employed; in 1873, 24 boats; in 1874, 8 boats; in 1875, 9 boats. My conclusion that the Company had not properly cultivated its grounds in 1874-5 was partly founded on the fact that eight or nine boats were not sufficient for the cultivation of an oyster fishery, which extended over eight or nine square miles of sea bottom.

At that time the mature oysters, taken in this dredging, were carried to a fishery which the Company had acquired at South Deep, in the river Swale, where they were fattened for the market. The immature oysters, “brood” and “half ware,” to use the technical terms, were placed on the Company’s stock beds at Herne Bay. The Company, at the time of my last inquiry, had three such stock beds in the western half of the Herne Bay ground.

My inquiry concluded in February, 1876. During the whole of 1876 the Company pursued the same system. It had never less than one boat, and never more than five boats employed. In the first half of the year it had, on an average, 18 men, during the last half of the year 16 men, in its service. It is reasonable to conclude, therefore, that throughout the whole of that year it continued the system—the imperfect system—of cultivation which it had pursued up to the date of my second inquiry.

On the 8th of November, 1876, the Board of Trade issued its certificate depriving the Company of the eastern half of its grounds. In the following month the Company surrendered its fishery at South Deep; at the commencement of January, 1877, it concluded an arrangement with Mr. Gann, of Whitstable, for the sale of "so much of their stuff (oysters) from their stock beds as they liked to sell to him." Under this arrangement 367,450 oysters and brood were sold to Mr. Gann, in the first six months of 1877; the sales ceased for the season on the 23rd June. In 1877 the sales had been thus confined to the oysters from the stock beds. In 1878 and 1879 the Company concluded another arrangement with Mr. Roots, an oyster merchant of Herne Bay, under which it undertook to sell him the oysters dredged from the rest of the grounds. These sales concluded in the summer of 1879, and the Company's proceedings after that day assumed a different character, which must be described later on.

The Memorialists inferred from this evidence that (1) in 1877 the stock on the stock beds was dredged up and sold; (2) in 1878 and 1879 the Company, having no stock on the stock beds, realised the scattered remnants of its property by disposing of the oysters which it dredged up from the rest of the ground. As the case of the Memorialists turned partly on these two points, I propose to examine them with some care.

1st. As to the sales to Mr. Gann.

These sales were given to me week by week, for the 25 weeks during which they lasted. I think, however, that I shall make the account more intelligible if I group the sales into periods of four weeks. The account will then stand as follows:—

SALES of OYSTERS, &c. to Mr. Gann during the First
Half of 1877.

	Oysters.	Brood, &c.
Four weeks ending 27th January 1877	140,097	12,928 (a)
„ „ 24th February „	48,331	39,009
„ „ 24th March „	40,868	15,992
„ „ 21st April „	13,270 (b)	10,042 (b)
„ „ 19th May „	18,238 (c)	5,293 (d)
Five weeks „ 23rd June „	16,958 (e)	6,424 (e)
	277,762	89,688

(a) No sales of brood during the first three weeks.

(b) Sales during two out of the four weeks only.

(c) No sales during the week ending the 19th of May.

(d) Sales during two out of the four weeks.

(e) Sales during three out of the five weeks.

2nd. As to the sales to Mr. Roots in 1878 and 1879.

Mr. Roots had no account of these sales; the Company treated them as a cash transaction, and had also no account of them. But I was nevertheless able to trace the sales with some exactness. Mr. Roots sold the oysters which he purchased from the Company to the Whitstable Company, and the foreman of the Whitstable Company proved that in 1878 and 1879 he purchased 2704 oysters and 85,968 brood from Mr. Roots. The counsel of the Company endeavoured to show that, as Mr. Roots was a general oyster merchant, some of this brood may have come from other grounds than those of the Herne Bay Company. But, without entering into all the reasons for my opinion, I think it clear that substantially the whole of

the oysters and brood did come from the Herne Bay grounds.

In 1877, then, the Company sold 367,450 oysters and brood off the stock beds to Mr. Gann; in 1878-79, it sold 88,672 oysters and brood to Mr. Roots. The sales to Mr. Gann were only objectionable if they exhausted the stock beds; the sales to Mr. Roots were objectionable because they disposed of the stock with which the stock beds might have been partly replenished. The effect of these sales on the Company can, therefore, only be judged by ascertaining the state of the stock beds at the conclusion of them.

The Company, from its first formation, has kept a stock account of the oysters on the stock beds; but the account has been made up in a somewhat singular fashion. The Company has added together the number of the oysters which they have from time to time placed on the stock beds; they have deducted all the oysters they have taken from the beds, and they have called the difference between these two sums their stock. On this principle, after the sale of oysters and brood to Mr. Gann in 1877, there still remained 639,546 oysters and brood on the stock beds, and after the sales to Mr. Roots in 1878 and 1879, there remained 551,563 oysters. It is only just to Mr. Lovely, who was secretary to the Company from 1874 to 1879, and who produced the figures, to say that he did not attach much importance to them. I have myself no doubt that the account is almost if not quite valueless. An account which makes no allowance for the death of oysters from natural causes, from accidental circumstances, or for their destruction by their enemies, is not much more trustworthy than an estimate of the population would prove which deducted the number of emigrants from the number

of births, and omitted to notice the deaths. I, therefore, reject this estimate, and shall endeavour to deduce the state of the stock beds from less direct but safer testimony.

In making such a deduction, it is important to observe that the sales to Mr. Gann in 1877 decreased as the season advanced. In the four weeks of January the sale of oysters exceeded 35,000 a week. In the five weeks ending the 23rd of June, the sale of oysters (in the three weeks during which sales took place) averaged only 5650 a week. A similar decrease took place in the sales of brood, and this diminution in the sales was certainly not due to any diminution in the machinery of capture. The Company had only three boats employed in January: they had five at work in June. It is true that the boats, according to Mr. Lovely, were employed "catching for Mr. Gann and dredging over the ground." But, as this description applies to the whole six months, I think it a fair inference that the stock on the stock beds was gradually reduced throughout the first half of 1877.

This conclusion is confirmed by the evidence of Mr. Jeffries, the Company's foreman in 1877. He states distinctly that "after the last inquiry they caught up the oysters on the stock beds, and sold them to Mr. Gann, who came for them. Took up all the oysters they could get." It is also indirectly confirmed by the evidence of William Rose, who was working for the Company in 1878 and 1879. Rose declares that in those years the men were allowed to go all over the ground, and were not even prohibited from working on the stock beds. "All the oysters on the stock beds were caught, and he could go anywhere." This concurrence of testimony seems to show that the stock on the stock beds had been reduced to very small proportions by June, 1877. But I do not think that

Rose is accurate in saying that all the oysters on the stock beds were caught. The sale of oysters in 1878 and 1879, according to Mr. Lovely, produced—

				£	s.	d.
During the first half-year of 1878	..			388	0	0
„	second	„	„	15	19	0
„	first	„	1879	345	18	3
				<hr/>		
				£749	17	3

But the sales to Mr. Roots of 88,672 oysters and brood only yielded, at 6s. a hundred, the price which he paid for them, £266; it follows that, in the same period, the Company must have sold oysters worth £484 to other persons. As Mr. Roots had all the oysters not taken from the stock beds, it follows that this £484 must have been received from oysters taken from the stock beds,* and that these sales must have further reduced the stock on these beds, already dangerously attenuated by the sales to Mr. Gann in 1877.

I think, then, it is clear that the stock on the Company's stock beds was reduced to very small proportions at the end of June, 1877, and that it was further reduced at the end of 1879. And I am inclined, indeed, to conclude that the stock beds at the latter date can be hardly said to have existed. I am confirmed in this conclusion by another branch of the evidence which I received, and to which I must now allude.

* This inference is supported by the evidence of Mr. Lovely, which has already been quoted. He says that the stock on the stock beds was reduced from 639,546 in 1877 to 551,563 in 1879, or by 88,000 oysters. The cash value of 88,000 oysters, at 11s. a hundred, would be exactly £484; 11s. a hundred would have been a good but not an excessive price for Herne Bay oysters, in the seasons of 1878 and 1879.

Up to June, 1879, the stock beds had been buoyed off, and a watch boat, the "Robert," had been moored in their immediate neighbourhood: on the 30th of June, 1879, the watch boat was laid up at her inner moorings, and the buoys which marked the position of the stock beds were removed. I am particularly anxious to guard against any false deduction from these facts. I have no doubt that the watch boat was taken off as a measure of economy; I have also no doubt that the buoys were removed in consequence of the absence of the watch boat, as a measure of precaution. But I cannot think that either the watch boat would have been taken off, or that the buoys would have been removed, if the Company had thought that the 550,000 oysters, shown in Mr. Lovely's account, or one-tenth of that number, were left on the old stock beds. I think, therefore, that I am justified in concluding that, after the 30th of June, 1879, the stock beds did not exist.

The removal of the watch boat was not the only expedient adopted for economical reasons, in 1878 and 1879. In 1878 the Company still possessed five boats of its own, the "Robert," the "Swift," the "Spray," the "Fern," and the "Flash." Three of these, the "Swift," the "Spray," and the "Flash," were sold at the end of 1878, or the beginning of 1879. The "Fern" was laid up in the spring of 1879, the "Robert" in June, 1879. The crews were also paid off, and on 31st October Mr. Lovely, who had acted as secretary to the Company for five years, and who had proved himself a very efficient officer, resigned his office.

Mr. Lovely was succeeded by Mr. Freeman, who became managing director of the Company. It is a matter of common knowledge at Herne Bay, though the fact did not actually come out in the evidence before me, that Mr.

Freeman purchased the Company's land at Hampton. He intended to build on the ground, but his investment was not successful. His own health failed, and he became so ill that he was unable to attend my inquiry. I annex to this Report a medical certificate respecting his illness. The advisers of the Company told me that they had been unable to find any record of the proceedings of the Company from the time at which he assumed the management of it. It appeared, however, from the evidence, that with the exception of a period of seven weeks during May and June, 1880, when the "Robert" was employed dredging, assisted during three weeks out of the seven by about three other boats, nothing whatever was done on the ground from June, 1879, to May, 1881.

During the interval, throughout which no watch boat was employed, the Company employed a man, Stupple, to watch the ground from the shore. Stupple had a small boat at his disposal, which he could use to follow any boats trespassing on the ground at all times, when neither the weather nor the tide prevented him from doing so. The Company also allowed two other men, a father and a son, the privilege of "trotting" for whelks on the grounds, on condition that they assisted Stupple to watch while they were trotting. I have every reason to believe that the three men honestly endeavoured to do their best for the Company. But I cannot help thinking that the system was a very inefficient one. The counsel of the Company, indeed, endeavoured to show that a man standing on the shore could command the whole ground. But it is obvious that he could not see whether a boat was dredging on or off the grounds unless it passed immediately between him and one of the buoys which marked the sea boundary of the grounds. In fact the Company, during the last few

months, has itself shown its sense of the inefficiency of the system by replacing the watch boat.

On the whole, then, it seems to me that, from the 30th of June, 1879, till the last few weeks, the Company can hardly be said to have existed. The land which it had acquired on its formation was disposed of; the pier which it had been authorised to build was in ruins; the tramway which it had been empowered to construct was abandoned; the boats which it had bought were either sold or laid up at their moorings; the stock beds had been virtually dredged away; with the exception of a short interval of a few weeks, no work was done on the ground; no watch boat was stationed on the ground to ward off poachers; and the system of watching which was adopted was economical rather than efficient; no record of the Company's proceedings was made after the 30th of October, 1879; and the Company, though it still had a legal existence under its Act, could hardly be said to have been alive.

I have no desire, either in what I have said or in what I am about to say, to press hardly on the Company; but it seems to me that its history, from 1876 downwards, resembles a career which unfortunately occasionally occurs in private life. From December, 1876, to June, 1879, the Company sustained a precarious existence by realising the scattered remnants of a valuable property. From June, 1879, to May, 1881, it had few or no more remnants to realise, and it retired into obscurity.

I should sincerely regret if it were inferred from the parallel which I have thus drawn that the management of the Company, at any rate its present management, was extravagant. The Company, as it seems to me, owes much of its misfortunes to the exaggerated notions, formed in 1864, of the profits of oyster culture. Its managers

assumed, as a matter which did not admit of dispute, that they would be able to draw a very large income from the grounds, and that they were accordingly justified in sinking large quantities of capital. It will be seen from one of my previous reports that preliminary and Parliamentary expenses cost the Company £12,600; leasehold and freehold property £10,300; the works which it was compelled to undertake, and which are either decayed or abandoned, £20,800. The Company therefore spent £43,700, nearly half its capital, before it attempted to earn a shilling. It will be seen from another of my reports that in the first five years of its existence its expenditure on labour, and the purchase of oysters, exceeded by more than £28,000 the whole of its sales; without reckoning its other and necessary expenditure, the Company had in these ways sunk nearly three-fourths of its capital. It had already exhausted its resources, and its profits did not come. It had no alternative but to retrench, and retrenchment, as it involved imperfect cultivation of the ground, naturally exposed it to attack. As its embarrassments became more pressing, its retrenchments became more marked, till at last, after 1877, it maintained a precarious existence by selling the stock from its stock beds, and disposing of the little brood which it collected over the ground.*

Mr. Bennett, the Company's counsel, practically ad-

* It may be worth while stating at this point what the embarrassments of the Company were. In June, 1879, it had called up its whole capital of £100,000, and it had borrowed on debentures and otherwise £800, and it owed about £1,100 to sundry creditors. Its assets were land and leaseholds (at cost), £10,100; plant, £2,100; stock of oysters, £2,200; debts due to it and cash in hand, £150. Its real property is now sold. The present value of its plant and stock may probably be inferred from any careful perusal of this Report.

mitted the whole of these facts ; he, indeed, naturally endeavoured to show that the Company had done more towards the cultivation of the ground than the Memorialists alleged, and that the system of watching which it pursued was more efficient than they allowed. But he did not attempt to pretend that the Company had pursued the course which, under other circumstances, it would have been its duty to have followed. The Company, he said, was impecunious ; its impecuniosity had forced it to sell its oysters and brood. Such sales were not in themselves unreasonable ; they were forced on the Company by its financial necessities.

Before I proceed to consider the reasons which the Company put forward, why the certificate of the Board of Trade should not issue on these facts, it may be convenient if I add that the almost continuous neglect of the grounds from June, 1879, to May, 1881, is perceptible enough on any careful inspection of them. I am particularly anxious to avoid deducing any conclusion unfair to the Company from my personal inspection of the ground, on the morning of Saturday, the 13th of August, a detail of which I insert in the Appendix. An oyster ground is naturally dirty in the summer ; sea-weed, like land-weed, grows rapidly in hot weather. Weeds collect mud, and the grounds consequently, as the summer advances, become dirtier and dirtier. But making every allowance for this circumstance, I am bound to say that the state of the ground, as I found it on the morning of the 13th of August, was worse than I expected. Many of the oyster shells were covered with ross, many of them and many stones were speckled with the red growth which fishermen call "quats ;" the weed was thick on the ground, and except on an old mussel bed off the Herne Bay Pier,

where the shells of the dead mussels remained, there was an absence of cultch. Making every allowance for the difference of the seasons, I cannot help concluding that the grounds had deteriorated since I dredged over them in February, 1876.

So far, then, my Report is in every respect against the Company. But I now proceed to notice the reason which its representative put forward why the certificate of the Board of Trade should not issue. It had failed, so he argued, because it had been impecunious; it would not fail, so he contended, because it was impecunious no longer. During the last few weeks it has concluded an arrangement with Mr. Davies, a wine merchant in London. Mr. Davies intends to purchase a certain number of shares in the Company; he proposes, in addition, to put into it some extra capital; and with a view to this arrangement, which is provisional on the results of this inquiry, he has acted for the last two months as managing director. Mr. Davies, who offered his evidence at my inquiry, stated his proposal in the terms which I have repeated it. But I ought to add that, though he did not give precisely either the number of shares which he intended to purchase, or the amount of capital which he proposed to embark, Mr. Davies is a substantial person, connected with many London establishments in which there is a large sale of oysters.

The effects of Mr. Davies' assistance are already visible. The watch boat was again restored to her old moorings in May; a new stock bed, the foundations of which were partly laid by Mr. Lovely in 1877, with cultch taken from the old beds, has been formed; and, during the three weeks which preceded my inquiry, some nine boats were hired and employed on the ground. The representatives

of the Memorialists endeavoured to show that the boats, which were put on after my inquiry was announced, would not have been put on but for my inquiry. Whatever grounds there may be for such an inference, I think it fair to assume, for my present purposes, that the boats were put on, not in consequence of my inquiry, but in consequence of the assistance which Mr. Davies is rendering to the Company.

Is there, then, anything in the assistance which Mr. Davies is rendering to the Company which should induce the Board of Trade to refrain from issuing the certificate which otherwise it could hardly avoid issuing, that the Company is not properly cultivating the grounds ?

If I have succeeded in stating the foregoing facts clearly, the Board of Trade itself will be quite as able as I am to answer that question ; and it is only because the Board will probably expect me to indicate my own opinion that I venture to state the grounds on which the answer to the foregoing question should, in my judgment, be based.

In the first place, it seems to me that nothing but the clearest prospects of promoting the public advantage can, as a general rule, justify the depriving of public fishermen of the rights of fishing which they enjoy in the territorial waters of the kingdom. I do not wish to put the matter in a sensational or rhetorical form ; but it is the bare fact, which ought to be borne in mind, that those rights were secured to their ancestors and themselves more than six centuries ago, by a provision of the Great Charter, and that every appropriation of a fishery repeals to the extent of the appropriation a provision of Magna Charta.

In the next place, it seems equally clear to me that the Legislature, if its opinion may be inferred from the preamble, as well as from the provisions of the 32nd sec-

tion of the Herne Bay Act, thought that nothing but clear public advantage could justify the appropriation to, or retention by, a public company of the Herne Bay grounds.

In the third place, I am unable to find that the public is deriving, directly or indirectly, any advantage from the existence of the Herne Bay Company.

Looking at the matter, then, from a public point of view alone, I should be disposed to recommend that the certificate of the Board of Trade should issue, and that the Company should be deprived of its whole grounds.

But it is one of the unfortunate circumstances of the present case that it is impossible to look at it from a public point of view alone, or to ignore the position of the shareholders of the Company.

These persons, *bonâ fide*, subscribed £100,000 for the sake of pursuing an object which they believed, and which the Legislature believed, to be profitable and laudable.

The utmost that can be said of the directors to whom they entrusted the management of the money, and even this cannot be said of the present directors, is that they have been extravagant and unwise. They have always endeavoured to carry out the objects of their Act; they have failed, as most other oyster culturists have failed during the last few years.

I do not know that there is much reason for hoping that Mr. Davies will achieve success, where his predecessors and colleagues have only met with failure. The mere fact that he is sanguine proves nothing; to be sanguine is the characteristic of promoters. But undoubtedly he has a chance, just as the original Company had a chance, of success, and his chances are the better of the two, because (1) he is not weighted with the heavy expenditure under which the Company in the first instance laboured; and (2)

he has the benefit of the experience which the Company has acquired by a long and costly experiment.

Whatever prospects of success, moreover, Mr. Davies may have, his assistance affords the sole chance which the shareholders of the Company still retain of obtaining any return for their heavy outlay. The chance may not be a good one ; but I should presume that the Board of Trade would hesitate to deprive them of it utterly except on very clear grounds of public necessity.

And on this point it is worth observing that the division of the grounds, which took place in 1876, has not proved of much advantage to public fishermen. It was stated by the counsel of the Company, and it was not denied by the representatives of the Memorialists, that with the exception of a short period after the issue of the Board of Trade's certificate, the public fishermen have not dredged on the grounds which were then thrown open to them. They allege, I believe, that the ground is ruined by neglect, and that dredging upon it no longer pays. I hope that I may not be understood as supporting this allegation. It seems to me only to show that the last few years have been bad years, and it does not, in my judgment, follow that the public fishermen, under more favourable circumstances, would not resume dredging on the ground. The fact that they have not yet done so, however, tends to throw a doubt on the advantages which the public would secure by throwing open the remainder of the grounds.

I think, therefore, that having regard to the expenditure which the Company has incurred, and to the offer of assistance which it has received from Mr. Davies, it might still be left in possession of some parts of the ground. But I do not propose that the portion which should thus be left to it should be large. I believe that, both from the

Company's point of view as well as from a public point of view, it is desirable that it should be only small, and that whatever prospects the Company may have of recovering its position, those prospects will be better if its efforts are concentrated on a small portion of sea bottom.

I propose, therefore, that the Company should be allowed to retain a portion, one mile wide, of its present grounds. I suggest that the mile should be measured along the shore, half a mile on either side of the Company's decayed oyster fishery pier at Hampton, and that the western and eastern boundaries of the reduced ground should be drawn from either end of this measured mile, parallel with the present western boundary of the Company's grounds, till they reach the present seaward boundary.

I mention these limits because the Company's new stock beds will be in about the centre of the ground thus reserved to it. But if, for any reason which I have overlooked, the Company should prefer that the mile of ground should be moved either eastwards or westwards, I should advise the Board of Trade to comply with such a request. It is my intention to allot to the Company the ground which will be most convenient to it, and if any other portion of the ground of the same size is, in the Company's judgment, more convenient, I should be ready to modify my recommendation accordingly.*

I cannot conclude this Report without apologising for the length to which it has extended. My only excuse for

* In the certificate issued by the Board of Trade, on the 31st of December, 1881, on the recommendation of this Report the mile was, at the request of the Company, measured from a point 800 yards west of the shore end of the Hampton Pier, to a point 960 yards east of the same pier.

its length is the anxious desire which I have felt to lay all the facts of a very difficult case before the Board of Trade, and to do, as far as I could, complete justice to the Company and the Memorialists. My previous observations will have indicated my general conclusions. But, for the sake of clearness, I will recapitulate them here.

1. During the twelve months preceding the date upon which my inquiry was ordered, as well as during the twelve months preceding the presentation of the memorials upon which my inquiry was founded, the Herne Bay, Hampton, and Reculver Oyster Fishery Company cannot be said to have cultivated its grounds.

2. Its failure to cultivate them arose from no desire, on the part of the directors, to neglect or evade its duties, but from financial embarrassments.

3. During the last few weeks it has made an arrangement with Mr. Davies, which affords it some prospect, some slight prospect, of retrieving its financial position.

4. In consequence of this arrangement, instead of recommending, as I should otherwise have recommended, that the whole of the grounds should be thrown open to the public, I suggest that the Company should still be left in possession of a small portion of its grounds, one mile in width, extending half a mile on either side of Hampton Pier.

I have, &c.,

(Signed) S. WALPOLE.

C. C. Trevor, Esq., &c., &c.,
Board of Trade.

ADDENDUM.

Results of Dredging on the 13th August, 1876, on Herne Bay Company's Grounds.

Wind: fresh, north-west, on shore.

1st. Six hauls from the western boundary to Hampton Pier, about half-way between sea boundary and low-water mark.

1st haul: 1 dredge—0 oysters 1 small five-finger.

2 „ —0 „ 0 five-fingers.

2nd haul: 1 „ —0 „ 3 small five-fingers.

2 „ —0 „ 0 five-fingers.

3rd haul: 1 „ —3 „ 0 „

2 „ —0 „ 1 „

4th haul: 1 „ —0 „ 3 „

2 „ —1 „ 2 „

5th haul: 1 „ —2 „ 3 „

2 „ —0 „ 1 „

6th haul: 1 „ —0 „ 0 „

2 „ —1 „ 0 „

Total of 6 hauls 7 oysters 14 five-fingers.

Soil: stone; very little or no cultch; much weed.

2nd. Two hauls on new stock bed.

Total of 2 hauls 36 oysters 3 five-fingers.

Soil: stone; a little cultch; some weed; soil not clean.

3rd. Six hauls middle of ground between Hampton and Herne Bay Piers, and off Herne Bay Pier.

Total of 6 hauls 5 oysters 25 five-fingers.

Soil: stone; a little cultch; much weed.

4th. Three hauls east of Herne Bay Pier.

1st haul: 1 dredge 1 oyster 3 five-fingers.

2 „ 0 „ 4 „

2nd haul: 1 „ 1 „ 2 „

2 „ 0 „ 4 „

3rd haul:	1	„	0	„	0	„
	2	„	1	„	3	„

Total of 3 hauls 3 16

Soil as before.

5th. Eight hauls on off grounds, east of Hampton Pier.

1st haul: 1 dredge—0 oysters 1 five-finger. 0 dog wheelks.

2	„	—0	„	0	„	0	„
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2nd haul:	1	„	—0	„	1	„	0	„
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2	„	—0	„	0	„	0	„
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3rd haul:	1	„	—1	„	1	„	0	„
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2	„	—0	„	2	„	6	„
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4th haul:	1	„	—1	„	2	„	4	„
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2	„	—0	„	4	„	0	„
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5th haul:	1	„	—1	„	2	„	1	„
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2	„	—1	„	6	„	0	„
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6th haul:	1	„	—0	„	3	„	0	„
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2	„	—0	„	0	„	0	„
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7th haul:	1	„	—1	„	3	„	0	„
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2	„	—0	„	1	„	3	„
---	---	----	---	---	---	---	---

8th haul:	1	„	—0	„	1	„	0	„
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2	„	—1	„	0	„	0	„
---	---	----	---	---	---	---	---

Total of 8 hauls 6 oysters 27 five-fingers 14 dog-wheelks

The ground on the 4th, 5th, and 6th of these hauls was cleaner than elsewhere, with much cultch, the shells of dead mussels, an old mussel bed at one time having existed here.

Elsewhere the soil was everywhere dirty, with much weed.

CHAPTER XXIII.

OYSTER CULTURE IN FRANCE.

STATE OF OYSTER CULTURE IN 1859—SAD RESULTS OF OVER-DREDGING—RESOLVE OF THE GOVERNMENT—M. COSTE'S SUCCESS—BŒUF'S SUCCESSFUL EXPERIMENTS—THE SPAWNING OF OYSTERS—GROWTH—WHEN DO OYSTERS BECOME REPRODUCTIVE FOR DREDGING?—LAKE FUSARO—FASCINES—ST. BRIEUC—ROCHELLE—ILE DE RE—STATISTICS—WISE POLICY OF THE GOVERNMENT—ECONOMY OF THE PARCS—GREENING OYSTERS—SPAT COLLECTORS—COST OF CONSTRUCTING A BED—DR. KEMMERER'S SYSTEM—"GUARDIANS"—PRESENT-TIME CULTURE—THE NEW DECREE.

It is hardly an exaggeration to say that about forty years ago there was scarcely an oyster of native growth in France; the beds had become so exhausted from over-dredging as to be unproductive, and the people were consequently in despair at the loss of this favourite adjunct of their banquets, and had to resort to other countries for such small supplies as they could obtain.

As an illustration of the over-dredging that had prevailed, it may be stated that oyster farms, which formerly employed fourteen hundred men, with two hundred boats, and yielded an annual revenue of 400,000 francs, had become so reduced as to require only one hundred men and twenty boats. Places where at one time there had

been as many as fifteen banks and great prosperity among the fisher class, at the period I allude to had become almost oysterless. St. Brieuç, Rochelle, Marennes, Rochefort, &c., had all suffered so much that those interested in the fisheries were no longer able to stock their beds, thus proving that notwithstanding the enormous fecundity of these sea animals, it is quite possible to overfish them.

An estimation of the effect of excessive fishing in France may be formed by examining the results of such beds as have records upon the subject. The most instructive of these are the records of the production of the beds of Cancale Bay, which extend over a period of sixty-eight years—from 1800 to 1868. The beds in the bay comprise an area of about 150 acres, and from 1800 to 1816 produced from 400,000 to 2,400,000 a year. This, however, was the period of the Napoleonic wars, and the fishing was much disturbed by the presence of English cruisers.

During this time the beds became so thickly stocked that the oysters were in some places a yard thick. After the close of the war the fishing improved, and the oysters were removed in larger and increasing numbers until 1843. From 1823 to 1848 it is supposed that the dredgers were living upon the oysters accumulated during the period of enforced rest, from 1800 to 1816. In 1817 the number of oysters produced was 5,600,000, and until 1843 there was a constant increase, the number taken in the latter year being 70,000,000. In 1848 it was 60,000,000; thenceforward there was a constant decrease. From 1850 to 1856 the decrease was from 50,000,000 to 18,000,000, supposed to be the effect of over-dredging. From 1859 to 1868 the decrease was from 16,000,000 to 1,079,000; the oysters having almost entirely disappeared from the beds, though on account of the suffering condition of the inhabitants of

the shores it was almost impossible to prevent it. In 1870 there was a complete wreck of the bottom, which could only be remedied by a total prohibition of the fisheries for several years.

From the beds of the districts of Rochefort, Marennnes, and Oléron, there were taken in 1853-'54, 10,000,000 oysters, and in 1854-'55 15,000,000. On account of exhaustive fishing, in 1863-'64 only 400,000 could be obtained.

It was under these circumstances that M. Coste instituted that plan of oyster culture which was so much noticed in the scientific journals of the time, and which has been so successful since. At the instigation of the French Government, the professor made a voyage of exploration round the coasts of France and Italy, in order to inquire into the condition of the sea fisheries which were, it was thought, in a declining condition, and study how they could be aided by artificial means, as the fresh-water fisheries had already been aided through the re-discovery, by Joseph Renny, of the long-forgotten art of pisciculture. Coming to Lake Fusaro, the plan of the oyster-breeders there struck M. Coste as being eminently practical, and suitable for imitation.

The mode of oyster-breeding at this place was from ancient times, as now, to erect artificial pyramids of stones in the water, surrounded by stakes of wood, in order to intercept the spawn, the oysters being laid down on the stones. Faggots of branches were also used for collecting the spawn, which requires, within a few hours of its emission, to secure a speedy holding-on place, or be lost for ever. M. Coste had one of the stakes pulled up, and was gratified to find it covered with oysters of all ages and sizes.

Acting upon the advice of M. Coste, the system of cultivation that had been so long and successfully carried on at Lake Fusaro was, with one or two slight modifications, strongly recommended by the French Government to the people as being the most suitable to follow, and experiments were at once entered upon with a view to prove whether it would be as practicable to cultivate oysters among the agitated waves of the open sea as in the quiet waters of Fusaro.

In order to settle this point, it was determined to renew the old oyster beds of the Bay of St. Brieuc, and immediate, almost miraculous, success was the result. The fascines laid down soon became covered with spat, and branches were speedily exhibited at Paris and other places containing thousands of young oysters. The experiments in oyster culture tried at St. Brieuc were commenced, early in the spring of 1859, on part of a space of three thousand acres. A quantity of breeding oysters, approaching to three millions, was laid down either on the old beds, or on newly constructed longitudinal banks; these were sown thickly on a bottom composed chiefly of immense quantities of old shells, the "middens" of Cancale in fact, where the shell accumulations had become a nuisance; so that there was a more than ordinary good chance for the spat finding at once a proper holding-on place. Then again, over some of the new banks, fascines of boughs were sunk and chained over the beds, so as to intercept any portion of the spawn that was likely, upon its rising, to be carried away by the force of the tide. In less than six months the success of the operations in the Bay of St. Brieuc was assured, for at the proper season a great fall of spawn had occurred, and the bottom shells were covered with the spat, while the fascines were so thickly coated with

young oysters that an estimate of 20,000 for each fascine was not thought an exaggeration.

But a year before the date of the St. Brieuc experiments, the artificial culture of the oyster had been successfully commenced on another part of the French coast, namely, at the Ile de Ré, near La Rochelle, in the Bay of Biscay, which was, in 1868, and is still so, I believe, the capital of French oysterdom, having more *parcs* and *claires* than Marennes, Arcachon, Concarneau, Cancale, or all the rest of the coast put together, and which, before it became celebrated for its oyster growing, was only known in common with many other places in France for its successful culture of the vine. It is curious to note the rapid growth of this industry on the Ile de Ré; it was begun in 1858, and in 1865 there were four thousand *parcs* and *claires* upon its shores.

It was inaugurated by a stonemason, having the curious name of Bœuf. This shrewd fellow had been thinking of oyster culture simultaneously with Professor Coste, and wondering if it could be carried on on those portions of the public foreshore that were left dry by the ebb of the waters. He determined to try the experiment on a small scale, so as to obtain a practical solution of his "idea," and with this view he enclosed a small portion of the foreshore, by building a rough dyke about eighteen inches in height, and in this *parc* he laid down a few bushels of oysters, placing amongst them a quantity of large stones which he gathered out of the surrounding mud. His initiatory experiment was so successful that, in the course of a year, he was able to sell £6 worth of oysters from his *parc*. This result was of course very encouraging to the enterprising mason, especially as the oysters went on growing while he was at work at his own proper business. Elated by the profit of his ex-

periment, he proceeded at once to double the size of his parc, and by that means more than doubled his commerce, for in 1861 he was able to dispose of upwards of £20 worth of his oysters, and that without impoverishing in the least degree his breeding stock. He still continued to increase the dimensions of his parc, so that by 1862 his sales had increased to £40.

As might have been expected, Bœuf's neighbours had been carefully watching his experiments, uttering occasional sneers no doubt at his enthusiasm ; but, for all that, quite ready to go and do likewise whenever the success of the industrious mason's experiments became sufficiently developed to show that they were profitable.

After Bœuf had demonstrated the practicability of oyster farming, the extension of the system all over the foreshores of the island was rapid and effective, so much so that two hundred beds were conceded previous to 1859, while an additional five hundred beds were speedily laid down, and in 1860 large quantities of brood were sold to the oyster farmers of Marennes, for the purpose of being manufactured into green oysters, in their claires on the banks of the Seudre.

The first sales, after cultivation had become general, amounted to £126. In the season of 1860-'61, the oysters sold brought the sum of £321, and next season the sum reached in sales was upwards of £500 ; and these moneys, be it observed, were for very young oysters, because, from an examination of the dates, it will at once be seen that the brood had not had time to grow to any great size. So rapid indeed has been the progress of oyster culture at the Ile de Ré that its foreshores, which were formerly a series of enormous and unproductive mud banks, are now covered with parcs and claires. There is only one drawback to these and

all other sea-farms in France : the farmers, we regret to say, are only "tenants at will," and liable at any moment to be ejected. (a)

A "marin," or almost anyone calling himself so, and possessing the qualifications of a boat, or even of only a pair of bare legs, may have an order which secures him about $2\frac{1}{2}$ acres below high-tide level, as an oyster "parc." Within this limit he may prevent anybody, not only from poaching by taking up his shell-fish, but also from doing anything which may injure his chance of successful "ostrea-culture."

These privileges are conferred upon him for nothing. It is considered to the advantage of the State to do so, for this sea-farm keeps him on the shore, as a man who may be called upon to take his part in coast or naval defence. But the person thus put in possession must protect his own property. If he be alone, as many are, with no one to help but the members of his family, his wife and son, or daughter, he must have his abode on the shore, near to his concession, so that he may watch over it himself. Others, who cannot be classed as being among the number of the maritime community, may nevertheless have a little water territory assigned to them as their individual property, for a payment of from thirty to fifty francs per annum, a sum which is practically only nominal. (b)

Notwithstanding this disadvantage (the drawback of being only "tenants at will"), the work of oyster culture has gone bravely forward, and it is calculated, in spite of the bad spitting of the last three years, that there is a stock of oysters in the beds—accumulated in only six years—of

(a) "Harvest of the Sea."

(b) "Oyster Culture." By the Marquis of Lorne. *Good Words*,
March, 1890.

the value of upwards of £100,000, which in another year or so will be doubled! The reader is not, however, to suppose but that much hard work had to be endured before such a scene of industry could be thoroughly organized.

When the great success of Bœuf's experiments had been proclaimed in the neighbourhood, a little army of agricultural labourers came down from the interior of the country and took possession of the shores, portions of which were conceded to them by the French Government, at a nominal rent of about a franc a week. The most arduous duty of these men consisted in clearing off the mud which lay on the shore in large quantities, and which (as I have stated elsewhere) is fatal to the oyster in its early stages. Next, the rocks had to be blasted in order to get stones for the construction of the parc walls; then these had to be built; foot-roads had also to be arranged for the convenience of the farmers, and carriage-ways had likewise to be made through the different farms. Ditches had to be contrived to carry off the mud, the parcs had to be stocked with breeding oysters, and to be kept carefully free from the various kinds of sea-animals that prey upon the oyster, and many other daily duties had to be performed that demanded the minute attention of the owners. But all obstacles were in time overcome, and some of the breeders have been so very successful of late years as to be offered a sum of £100 for the brood attached to twelve of their rows of stones, the cost of laying these down being about 200 francs.

To construct an oyster-bed thirty yards square costs about £12 of English money, and it has been calculated that the return from some of the beds has been as high as 1000 per cent.! The whole industry of the Ile is wonderful, when it is considered that it was all organized in a

period of seven years. Except a few privately-kept oysters, there was no oyster establishment on the island previous to 1858.

The following are authentic statistics of the oyster industry of the Island of Ré, when only in the fourth year of the venture :—

	Francs.
Parcs for collecting Spawn and Breeding	2,424
Fattening Ponds (Clairens)	839
Supposed number of Oysters in Parcs ..	74,242,038
Aggregate number in the Clairens	1,026,282
Revenue of the Parcs	1,086,230
Revenue of the Clairens.....	40,015
Hectares of Ground in Parcs and Clairens	146
Proprietors of Beds	1,700

But more interesting even than the material success that attended the introduction of this industry into the Island of Ré is the moral success that accompanied the experiment. Excellent laws were enacted by the oyster farmers themselves, for the government of their peculiar industry. A kind of parliament was devised, and is still in force, for carrying on arguments as to oyster culture, and to enable the four communities into which the population has been divided to communicate to each other such information as may be found useful for the general good of all engaged in oyster farming. Three delegates from each of the communities are elected to conduct the general business, and to communicate with the Department of Marine when necessary. A small payment is made by each person, as a contribution to the general expense, whilst each division of the community employs a special

watchman to guard the crops, and see that all goes on with propriety and good faith. (c)

In his interesting Magazine Article on "Oyster Culture," the Marquis of Lorne says :—"In France, especially at Arcachon, it is usual to place the 'guardians' in covered boats, anchored near the grounds where the oysters are laid down. These boats are large and comfortable enough for the guardian and his family, and constant vigilance is necessary on his part to prevent poachers from harrying the places where the oysters are lying. He is usually armed with a fowling-piece or musket, and the feeling of the people connected with the oyster industry being against the poachers, as filchers of the earnings of themselves and of their wives and children, scant ceremony is shown to any intruder. Not long ago, where along those shallows and sandbanks the guardian boats lie like African waggons, with their white curved roofs, a shot was heard at night, and little notice was taken. When in the morning an inquiry was made, the fact that a man had been fired at excited but little remark, all that was said being, 'It was Jacque, the oyster-poacher, we believe ; anyway, the tide came up quickly and took away the body.'

And this efficient watch is allowed, although the property guarded is nominally only given by grace and favour of the State for a time. When any person obtains permission to "cultivate" within a certain area, he is bound before a year has passed to have commenced the works necessary, and he is told that no right of property is given to him in respect of his marine allotment, but only a right of use, "essentially precarious, and revocable at the first requisition by the administration, without compensation."

The 30 or 50 francs per "hectare," or $2\frac{1}{2}$ acres, paid, is also liable to be diminished, or brought up to those figures, according to the value of the ground for breeding, and it is let in terms of five years. Practically, these reservations do not apply, unless there be proof that the first "concessionaire" has been useless, when his neighbour can step in and farm successfully where the first has failed.

Although each of the oyster farmers of Ré cultivates his *parc* or *claire* for his own sole profit and advantage, he most willingly obeys those general laws that have been enacted for the good of the community.

It is pleasant to note this (continues Mr. Bertram). We cannot help being gratified at the happy moral results of this wonderful industry, and it will readily be supposed that with both vine culture (for the islanders have fine vineyards) and oyster culture to attend to, these farmers are kept very busy. Indeed, the growing commerce—the export of the oysters, and the import of other commodities for the benefit of so industrious a population—incidental to such an immense growth of shell-fish as can be carried on in the 4000 *parcs* and *claires* which stud the foreground of Ré, must be arduous; but as the labour is highly remunerative, the labourers have great cause for thankfulness. It is right, however, to state that, with all the care that can be exercised, there is still an enormous amount of waste consequent on the artificial system of culture; the present calculation is, that even with the best possible mode of culture the average of reproduction is as yet only fourteenfold; but it is hoped by those interested that a much larger ratio of increase will be speedily attained. This is desirable, as prices have gone on steadily increasing since the time that Bœuf first experimented. In 1859 the sales were effected at about the rate of 15/- per bushel for the lowest qualities

—the highest being double that price ; these were for fattening in the claires, and when sold again they brought from £2 to £3 per bushel.

One of the most lucrative branches of foreign oyster-farming may be now described—*i.e.*, the manufacture of the celebrated green oysters. The greening of oysters, many of which are brought from the Ile de Ré parcs, is extensively carried on at Marennes, on the banks of the river Seudre, and this particular branch of oyster industry, which extends for leagues along the river, and is also sanctioned by free grants from the State, has some features that are quite distinct from those we have been considering, as the green oyster is of considerably more value than the common white oyster. The peculiar colour and taste of the green oyster are imparted to it by the vegetable substances which grow in the beds where it is manipulated.

This statement, however, is scarcely an answer to the question “ why,” or rather “ how,” do the oysters become green ? Some people maintain that the oyster green is a disease of the liver-complaint kind, whilst there are others who attribute the green colour to a parasite that overgrows the mollusc. But the mode of culture adopted is in itself a sufficient answer to the question. The industry carried on at Marennes consists chiefly of the fattening in claires, and the oysters operated upon are at one period of their lives as white as those which are grown at any other place ; indeed, it is only after being steeped for a year or two in the muddy ponds of the river Seudre that they attain their much-prized green hue. The enclosed ponds for the manufacture of these oysters—and, according to all epicurean authority, the green oyster becomes “ *the oyster par excellence*”—require to be water-tight, for they are not submerged by the sea, except during very high tides.

Each claire is about 100 feet square. The walls for retaining the waters require therefore to be very strong ; they are composed of low but broad banks of earth, five or six feet thick at the base, and about three feet in height.

These walls are also useful as forming a promenade on which the watchers or workers can walk to and fro, and view the different ponds. The flood gates for the admission of the tides require also to be thoroughly water-tight, and to fit with great precision, as the stock of oysters must always be kept covered with water, but a too frequent flow of the tide over the ponds is not desirable, hence the walls, which serve the double purpose of both keeping in and keeping out.

A trench or ditch is cut in the inside of each pond, for the better collection of the green slime left at each flow of the tide, and many tidal inundations are necessary before the claire is thoroughly prepared for the reception of its stock. When all these matters of construction and slime-collecting have been attended to, the oysters are then scattered over the ground and left to fatten. When placed in these greening claires they are usually from twelve to sixteen months old, and they must remain for a period of two years at least before they can be properly greened, and, if left a year longer, they are all the better ; for I maintain that an oyster should be at least about four years old before it is sent to table. In a privately-printed pamphlet on the French oyster-fisheries, sent to me by Mr. Ashworth, it is stated that oysters deposited in the claires for feeding possess the same powers of reproduction as those kept in the breeding ponds. " Their progeny is deposited in the same profusion, but that progeny not coming in contact with any solid body, it inevitably perishes, unless it can attach itself to the vertical sides of some erection."

A very great deal of attention must be devoted to the oysters while they are in the greening-pond, and they must be occasionally shifted from one pond to another to ensure perfect success. Many of the oyster-farmers of Marennes have two or three claires suitable for their purpose. The trade in these green oysters is very large, and they are found to be both palatable and safe, the greening matter being furnished by the sea. Some of the breeders, or rather manufacturers, of green oysters, anxious to be soon rich, content themselves with placing adult oysters only in these claires, and these become green in a very short time, and thus enable the operator to have several crops in a year without very much trouble. The claires of Marennes furnish about fifty millions of green oysters per annum, and these are sold at very remunerative prices, yielding an annual revenue of something like two and a half millions of francs.

As to the kind of ground most suitable for oyster-growth, Dr. Kemmerer, of St. Martin's (Ile de Ré), an enthusiast in oyster-culture, gives us a great many useful hints. I have summarised a portion of his information:—“The artificial culture of the oyster may be considered to have solved an important question—namely, that the oyster continues fruitful after it is transplanted from its natural abode in the deep sea to the shores.

This removal retards but never hinders fecundation. The sea oyster, however, is the most prolific, as the water at a considerable depth is always tranquil, which is a favourable point in oyster-growth; but the shore oyster-banks will also be very productive, having two chances of replenishment—namely, from the parent oysters in the parcs, and from those currents that may float seed from banks in the sea. Muddy ground is excellent for the

growth of oysters ; they grow in such localities very quickly, and become saleable in a comparatively short space of time. Dry rocky ground is not so suitable for the young oyster, as it does not find a sufficiency of food upon it, and consequently languishes and dies. Marl is the most esteemed, and on it the oyster is said to become perfect in form and excellent in flavour. In the marl the young oyster finds plenty of food, constant heat, and perfect quiet. Wherever there is mud and sun, there will be found the little molluscs, crustacea, and swimming infusoria, which are the food of the oyster. The culture of the oyster in the mud-ponds and in the marl—a culture which ought some day to become general—changes completely its qualities ; the albumen becomes fatty, yellow or green, oily, and of an exquisite flavour. The animal and phosphorus matter increases, as does the osmozone. This oyster, when fed, becomes exquisite food. In effecting the culture of the sea-shores and of the marl-ponds, I am pursuing a practical principle of great importance, by the conversion of millions of shore oysters, squandered without profit, into food for public consumption. The green oyster, to this day, has only been regarded as a luxury for the tables of the rich ; but, as I have indicated, there are an immense number of farms or ponds on the Seudre, and I would like to see it used as food by everyone.”

The French oyster-farmers are happy and prosperous. The wives assist their husbands in all the lighter labours, such as separating and arranging the oysters previous to their being placed on the claires. It is also their duty to sell the oysters, and for this purpose they leave their home about the end of August, and proceed to a particular town, there to await and dispose of such quantities of shell-fish as their husbands may forward to them. In this they

resemble the fisherwomen of other countries. The Scotch fishwives do all the business connected with the trade carried on by their husbands; it is the husbands' duty to capture the fish only, and the moment they come ashore their duties cease, and those of their wives and daughters begin with the sale and barter of the fish.

Before going further, it may be stated that the best mode of receiving the spawn of the oyster has not been determined. M. Coste, whose advice is well worthy of being followed, recommended the adoption of fascines of brushwood to be fixed over the natural oyster-beds, in order to intercept the young ones; others again, as we have just seen, have adopted the *parcs*, and have successfully caught the spawn on dykes constructed for that purpose; but Dr. Kemmerer has invented a tile, which he covers with some kind of composition, that can, when occasion requires, be easily peeled off, so that the crop of oysters that may be gathered upon it can be transferred from place to place with the greatest possible ease, and this plan is useful for the transference of the oyster from the collecting *parc* to the fattening *claire*. The composition and the adhering oyster may all be stripped off in one piece, and the tile may be coated for future use. Tiles are exceedingly useful in aiding the oyster-breeder to avoid the natural enemies of the oyster, which are very numerous, especially at the periods when it is young and tender.

The oysters may be peeled off the tiles when they are six or seven months old. Spat-collectors of wood have also been tried with considerable success. Hitherto these tiles have been very successful, although it is thought by experienced breeders that no bottom for oysters is so good as the natural one of "cultch," as the old oyster-shells are called; but the tile is often of service in catching the

“floatsome,” as the dredgers call the spawn, and to secure that should be one of the first objects of the oyster-farmer.

We glean from these proceedings of the French pisciculturists the most valuable lessons, for the improvement and conduct of our British oyster-parcs. If, as seems to be pretty certain, each matured oyster yields about two millions of young per annum, and if the greater proportion of these can be saved by being afforded a permanent resting-place, it is clear that, by laying down a few thousand breeders, we may, in the course of a year or two, have, at any place we wish, a large and reproductive oyster-farm. With reference to the question of growth, M. Coste tells us that stakes which had been fixed for a period of thirty months, in the lake of Fusaro, were quite loaded with oysters when they came to be removed. These were found to embrace a growth of three seasons. Those of the first year’s spawning were ready for the market; the second year’s brood were a good deal smaller; whilst the remainder were not larger than a lentil. To attain miraculous crops similar to those once achieved in the Bay of St. Brieuc, or at the Ile de Ré, little more is required than to lay down the spawn in a nice rocky bay, or in a place paved for the purpose, and having as little mud about it as possible. A place having a good stream of water flowing into it is the most desirable, so that the flock may procure food of a varied and nutritious kind.

A couple of hundred stakes driven into the soft places of the shore, between high and low water mark, and these well supplied with branches held together by galvanised iron wire (common rope might soon become rotten), would, in conjunction with the rocky ground, afford capital holding-on places, so that any quantity of spawn might, in time, be developed into fine “natives.” There are hundreds

of places on the English and Irish coasts where such farms could be advantageously laid down.

Since the previous editions of this work were issued (continues Mr. Bertram), bad news has been received about the French oyster-farms, many of them having become exhausted through the greed of their proprietors, who at an early period began to kill the goose for the sake of its golden egg, a calamity that seems to be too frequently an attendant consequence of the present system of fishing economy. In the year 1863, as far as I can ascertain, the artificial system culminated at the Ile de Ré, and since then the beds have yearly become less prolific.

Such was the practical state of Oyster Culture in France at the time when Mr. Bertram wrote his "Harvest of the Sea," a highly-interesting and deeply-instructive work, as valuable to the pisciculturist and ostreologist of the period of its publication, as it is even now for reference to all concerned.

That considerable progress has been made by the French in this industry is beyond all doubt, and, aside from "Reports," is proved in the Marquis of Lorne's pleasing sketch already quoted from, and whence—desirous of impressing the reader with a just appreciation of its value from a national standpoint, together with its exemplary lesson for our tardy, and, *in this case*, short-sighted Government,—I respectfully venture to conclude this chapter with yet another extract, all which, though drawn upon without permission, will, I am led to hope, be excused; the more readily so, perhaps, since the following quotation will serve to strengthen my statement in regard to the high state of perfective utility in Oyster Culture attained to by the French, at the present time.

“Our French friends . . . rowed to a flat-bottomed sailer, which took us . . . to the flats, midway between Arcachon and the opposite shore.

“How is it that there is such a hedge of tufted saplings growing along the edges of the ‘terres emergentes,’ or bare flats, to which we are now quite close? There seems to be in some parts quite a thick plantation of them.

“Yes, . . . our protection against whelks, . . . starfish, and other things that are horrors to the youthful oyster.”

. . . . “The stakes do something to keep out these marauders and the dreaded dog-fish, which is particularly fond of such rich feeding grounds. These little sharks, if they do get through the palisades, are frightened by the waving crowns left on the stakes, and puzzled, turn and turn again, and then it is too late, for they are enclosed, and the visit of the keepers soon shows them that they have got ‘into the wrong box.’ . . .

. . . . “Our friend . . . jumped out into the shallow water, (and) hauled us past the palisades of saplings, all of which he had caused to be planted along the outside of his preserves, and we found ourselves alongside of lines of stakes driven down into the sand, and upholding, at a distance of two feet from the bottom, rows of square sieves. These sieves were double, the top one in each case shutting down on the lower, so as to make a box. In these boxes, protected behind their gratings like the ladies in the House of Commons, reposed the young oysters, listening in security to the debates of the wind and the waves. The stakes held their prisoners firm, and nothing could touch them in these grated asylums, where they were safe from weather, and the wickedness of marine monsters who might love them only for their flesh.

Hundreds of beautiful little shells there were in these double sieves, and there they will remain, fattening and growing with the inflow and the outflow of the sea, that brings them food every twelve hours, thrusting it between their prison bars, and certain to come again with more next day. There they will stay until they have grown to be two inches across the shell, or perhaps a little less, and then they will be placed out in the enclosures, defended by the palisades of saplings. Behind the saplings we found that fairly substantial dykes had been constructed by means of strong stakes driven into the sand, with about $2\frac{1}{2}$ feet left above the sand bank. Boards had been placed along these in some places, and sand pressed in between this wall and another similar to it about four feet away. Again the dykes had often been constructed of mere fascines, or bundles of the long heather found in the forests. These allow a certain amount of the tidal water to flow through them, but they arrest the motion of any moving sand, and soon get wedged and jammed and heavy with the particles, so that they constitute a most efficient dam. These dykes are arranged in squares and parallelograms. The floor within is clean, and full of fairly matured oysters spread abroad upon the surface.

. . . . And soon we shoved off again, and floated up a narrow channel, A perfect network of dykes, enclosing square pools of water, was here formed on the sands. The water must be always sufficiently deep to prevent the fish from feeling the effects of frost in winter or being parboiled by the summer heats. Then it is not so easy a matter to make the enclosures. The dykes have to be always watched lest a breach be made, and although the elasticity of the heather fascines make it more difficult for the waves to make gaps, yet these occur and have to be

repaired. To prevent the deposit of mud from doing harm, it is necessary also to make the surface within the low sand walls convex, with a depression all around just within the dykes, so that there may be a natural surface drainage for the ebbing waters to flow off the centre ground, where the shells have been placed. This must be kept clear of weeds as well as fish of prey. The shells, too, must be frequently handled, and kept free of any weed that may attach itself to them.

Thus all these precautions require work and attention, and so the four thousand people employed in the Bay get their living—and fair wages, too, are earned. A man gets three francs a day, a woman two and a half, and youths and girls two francs. It is estimated that 200,000 people get their living in France in this way. Pretty heavy work has to be undertaken to keep the ground clear. All weeds must be removed, cockles and sand laid down where there is not enough, and a good clean floor made if it be not there. The annelides or worms, too, must be got rid of. They are injurious—sometimes they collect around them a mass of matter bad for their more delicate neighbours. ‘It does not so much matter about the little worms,’ said our friend, ‘the little worms spit, but they don’t blow like the big fat worms—the taupes: those are the rascals—they blow, and they scatter the mud about.’

The French Government has lately taken a step with regard to the oyster fisheries of the Republic, which is likely to create some talk in this country, especially among people who believe in the need and efficacy of “close time” as a means of protecting the “young beds.” The following relative information is taken from the *Morning Post*, 1889:—

By a decree of the President, recently promulgated, the annual close time for oyster fishing is entirely abolished, and henceforth oysters measuring more than five centimetres across may be taken, bought, and sold in the open markets, at all times and seasons of the year. Those of a lesser size may only be taken for the purposes of cultivation, or for laying down in new beds. The wisdom of the measure will, no doubt, be widely questioned here, for most Englishmen believe in a close time, under the impression that it tends to protect the beds from undue depletion, and thus helps to make the oyster more plentiful. It must not, however, be forgotten that there is at least something to be said on the other side of the question, and more than one expert could point to facts in this country which go far to prove that over-protection, in the shape of close time, is not always the good thing many imagine. Oyster plantations are necessarily situated in shallow sandy stretches of the seashore, where the rise and fall of the tide helps to keep the water clean and fresh, and where the ebb and flow of the water brings within reach of the growing spat an ample supply of the tiny animalculæ on which the oyster feeds and develops. Such shallow stretches of inshore water are, however, particularly liable to be choked up by the sand washed in with the tide, in which case the young oysters are really suffocated, and the bed is practically destroyed. Regular dredging keeps the ground open, and prevents the accumulation of sand-drift. A close time, especially if at all prolonged, has, of course, the reverse effect. And it is to the operation of the law enforced in this country, which prohibits the taking of oysters at certain periods of the year, that we owe the "silting up," as it is termed, of some of the finest oyster grounds on the east coast of England—that of the estuary

of the Wash, for example, once producing some of the finest oysters in the kingdom, just as neglect has ruined the most famous fishery of the west, which had its seat at Milford Haven. The French, therefore, are not without reason on their side in concluding to abolish the old close time for oysters, and instead to prohibit the sale for food of small, that is to say, immature oysters, which, apart from being unfit for consumption, tend to unduly deplete the beds. Apart from this, the circumstances which induced the French to enact a close time in 1882, have undergone a great change. The object in view was "to prevent the destruction of young broods, to assist the restocking of public and private grounds, and to protect the public against oyster poisoning." It is now, however, found that the several grounds where the oyster is cultivated are getting rather over-stocked, and cases of oyster poisoning—supposed to have been due to the consumption of immature and unhealthy fish—are now extremely rare.

In this country the mere mention of the French oyster fisheries suggests the famous beds of Arcachon and the Brest grounds—which, by the way, are exempted from the operation of the decree abolishing close time for the fishery. There is no question but that the Arcachon oyster-farm, under the careful supervision and encouragement of the French Government, has been made a model and example for all maritime peoples, and been successful beyond all expectation. It exports young fish for fattening to this and other countries, by the hundred millions yearly. Indeed, our own Whitstable now derives its chief supply of oysters for laying down from the French beds, and the Kentish dredgers have no objection to selling the foreign "settlers," which have grown fat in English waters, as genuine "natives," though they know well enough the

difference between "first" and "second" natives, as they call them, in order to puzzle the ignorant consumer. But it should not be imagined that because Arcachon has been so successful, the oyster fisheries in other parts of France are equally flourishing. Far from it; indeed, the "beds" in many of the once famous oyster creeks of the Republic are in as bad a condition as some on this side of the Channel. Brittany was formerly famous for its oysters, as might be expected seeing that the conditions under which they were cultivated were much the same as at Whitstable and Colchester. The Breton oysters were rather larger than those found at Ostend, but superior—at least many hold them so—to the Belgian. Now these are becoming rarer, like our own British natives. Only as recently as last month M. Bouchon-Brandely, the Inspector-General of the French Marine Fisheries, presented to the Government of the Republic a report on the condition and cultivation of the oyster-beds of Brittany, which he had recently been visiting. At St. Malo M. Bouchon-Brandely found the oyster industry almost ruined. The river Roma, in which the oyster has been cultivated for over 50 years, is admirably suited for oyster growing, but the local fishermen have altogether neglected the beds. With a little attention and under proper supervision, the Roma might be made the seat of one of the most flourishing oyster-farms of France. Westward of St. Malo is the once famous oyster ground of the Bay of St. Brieuc. This is reported to have been "entirely destroyed by the reckless use of the dredge." Young and old, the mature oyster capable of reproduction and the young fry coming on, have been dredged up without a thought as to whence the future supply is to come, with the result, of course, that there are no oysters whatever there at the present time.

Beyond the Bay of St. Brieuc, at Tréguier, are the natural beds which have yielded from times immemorial the Breton oyster, which we before mentioned. It was stated some little while back that these grounds were wholly destroyed, and that a disease, which no one understood, was killing off the young shell-fish. These reports were found to be exaggerated, and based upon the simple fact that a quantity of lime falling into the water, when a bridge was being constructed recently, had done considerable mischief among the young shells. Still the fishery was in anything but a prosperous condition. The Tréguier dredgers had fished without discretion, as these folk are wont to do, in spite of all official warnings. The general fishery took place at the lowest tides of the year, instead of at ordinary low tides, thus destroying the reserve of oysters for reproductive purposes. The beds were never "rested" or cleansed from pollution, and the people of the locality had been in the habit for years of helping themselves freely to oysters, whenever they felt disposed to, and with the most improvident recklessness. The French Inspector-General of the Fisheries actually thinks the best thing for the Tréguier "beds" would be to revert to the old law of 1750, by which oyster fishing in the creek of Tréguier was only permitted once every six years. And if this be considered too long a close season, the "grounds" should be closed for a couple of years, during which the beds should be properly cleaned and tended, and fresh spat laid down. Then, with the new regulations rigidly enforced, the Breton oyster would have a chance of multiplying apace, and becoming as plentiful again and in as good repute as it was a century ago.

As to the "once flourishing natural beds of the Roads of Brest," M. Bouchon-Brandely reports that they have

been utterly ruined by "every kind of wasteful and improvident fishing." At every point along the coast the same thing has been going on. The "rapacity of the dredgers" and the constant "disturbance of the young shell-fish have led to the destruction of the beds," or else considerably diminished the yield of oysters, and thus lessened the value of the fishing grounds. And, in addition, poaching goes on in these localities on quite an extensive scale. But in spite of all this, the position of the Breton oyster-beds, and the advantages they naturally possess for the cultivation of this variety of shell-fish, are so great that the French Inspector of Maritime Fisheries is of opinion that if only decent care be taken to protect them, they would speedily be made to flourish again. They only require replanting and rest for a time, until the young spat establish themselves. Then, if none but mature oysters be taken, and poaching be prevented, nature will do all that is needful to maintain and replenish the stock. As to the cost of keeping down poaching, the expense would be more than repaid by the increased takes made by the recognised dredgers. In proof of this, M. Bouchon-Brandely points to the condition of the oyster fishery in the neighbourhood of Vannes. There a little steamer regularly patrols the ground, watching the beds, seeing that would-be depredators are kept off, and the young oysters are undisturbed by poachers and others. The result is that there is a far more plentiful supply of oysters there, and the beds are in a far more prosperous condition, than in any other part along the coast. At Morbihan, where some precautions have also been taken against over-dredging and improvident takes, the beds are reported to be likewise in a less exhausted state than in Finistère. It is evident, however, that the same causes which have been

operating in this country to lessen the yield of the native oyster beds have led to like results in many parts of France, where the fishery has been left too much in the hands of the local fisher folk. As a consequence of M. Bouchon-Brandely's report, the French Government proposes to take further measures for the improvement of the oyster fisheries of the Republic, and to prevent their depletion, a step which ought to stimulate enterprise of a like kind in this country, where, owing to causes which it is unnecessary to indicate, the supply of this delicious and nutritive shell-fish is neither cheap nor plentiful, when it ought to be both.



CHAPTER XXIV.

OYSTER CULTURE IN FRANCE.

RETURN to an Order of the Honourable the House of Commons, dated 17th May, 1877; for Copy “of translation of a REPORT made to the Minister of Marine in France, by M. G. Bouchon-Brandely, Secretary of the College of France, relative to OYSTER CULTURE on the SHORES of the CHANNEL and of the OCEAN, and published in the ‘Journal Officiel de la Republique Française,’ of 22nd day of January, 1877.”

EDWARD STANHOPE.

Board of Trade, 17th May, 1877.

LIST OF FISHERIES INSPECTED.

COURSEULLES - SUR - MER—GRAND CAMP—SAINT VAAST - DE - LA-HOUE — REGNEVILLE — CANCALE — LE VIVIER-SUR - MER—FOSSEMORT, NEAR ST. MALO—BREST—BELON, NEAR QUIMPER—LORIENT—ESTABLISHMENT OF LE BRENEGUY—VANNES—ESTABLISHMENT OF M. POZZI—LES SABLES D’OLONNE—ILE DE RE—ILE DE OLERON—MARENNES—LA TREMBLADE—LE VERDON—ARCACHON—ESTABLISHMENT OF THE OSTRICULTURAL—ILE DES OISEAUX (PARCS OF CRASTORBE).

Paris, 29th December, 1876.

Monsieur le Ministre,

You have done me the honour to entrust me with a mission for the purpose of ascertaining the state of ostriculture upon our Channel and Atlantic coasts.

I return from my mission with the strong conviction that this new industry, so essentially French, has, after some preliminary hesitation due to its very novelty, entered definitely on such a stage of development and progress that nothing it may be hoped can now cause it to decline.

The ever-growing wants of the consumer, further increased by facilities and readiness of transport, and the diffusion of wealth, have attracted attention during the last 30 years and more. Agriculture was first obliged to meet the greater part of these wants ; but the incessant requirements of the public food market have not allowed any natural resource to be overlooked, and the rivers as well as the sea have been taxed to supply their quota.

In a few years our shores and watercourses were thoroughly exhausted, and the necessity for re-stocking the waters, and bringing the domain of fishery under the regular conditions of production, then became an economical question of the first order. Hence the origin and cause of two industries created in our days, viz., pisciculture and ostriculture.

As early as 1872 and 1873, the Minister of Public Instruction entrusted me with a double mission, to study river pisciculture both in France and abroad. I am compelled to admit, and do so with regret, that, while with many of our neighbours the stocking of rivers and streams with fish is carried on with marked success ; in France, the birthplace of pisciculture, where it had its first scien-

tific laboratory, where the 600 watercourses which divide the soil offer a field of labour of not less than 700,000 hectares ; in France, I say, pisciculture is not followed up with continuous or general attention. We can, however, at the present day, call the attention of those nations who have surpassed us in the art of cultivating waters to the progress which ostriculture has made on our shores.

The cultivation of oysters was, without doubt, practised in very ancient times. It is conducted now in nearly every locality where shell-fish form more or less an article of subsistence, but it is not, as with us, subjected to industrial regulations.

I should state that the Department of Marine is the department which has given France her oyster industry, the credit of first efforts and perseverance in the enterprise and the honour of obtaining the results shown in my Report.

The idea of establishing special places for retaining and preserving the spat which the oysters emit at the moment of gestation, is comparatively recent. It originated with a high functionary in your department, who reduced the theory to practice.

In 1853, when M. Coste was visiting the oyster grounds of Lake Fusaro, and was noticing there some attempts at ostriculture of a timid and unmethodical character, M. de Bon, then Commissaire de la Marine, and chef du Service at St. Servan, was occupying himself with the reconstruction of the old oyster-beds at the mouth of the Rance, and in the roads of St. Malo, by means of shells taken from the banks of the Bay of Cancale. He applied himself to the pursuit of these experiments with great perseverance. His efforts were crowned with success, and it is in his power to prove a fact, till then con-

tested, and of the greatest importance as affecting the new science, namely, that the oyster is capable of reproducing itself on suitable banks (*terrains émergents*), and that it is possible to obtain harvests of spat.

On the strength of this discovery, M. de Bon himself formed at St. Servan an experimental parc, literally a natural laboratory, in which he commenced a series of experiments on the means of attaching the spat. The attempts were a complete success, as M. Coste was able to prove and to announce in a report, dated 5th February, 1858, and inserted in the *Moniteur* of the 28th of June following. M. de Bon invented some collecting apparatus, and soon by way of complete demonstration sent a platform, of his invention, covered with spat, to the Minister. This was accompanied by a detailed report.

I should here advert to the part taken by M. Coste, professor in the College of France, at the cradle of the new industry. Whilst surveying the coast under commission from the Emperor, who had directed him to make experiments in maritime pisciculture, the illustrious embryogenist visited St. Servan in the month of August, 1857. There he found the culture of the mollusc inaugurated, and saw the decisive results which M. de Bon had obtained, both for the re-stocking of the natural banks, and for securing the spat. Here was the practical confirmation of his theories, and here, in many respects, the discovery of the means of execution of which he was in search. His lively imagination grasped with enthusiasm the discoveries of M. de Bon ; to popularise it, he consecrated his high situation in the College of France, his reputation and experience as a scientific man, and the declared support of the head of the State.

Suitable means were placed at M. Coste's disposal ; considerable sums were devoted to the task of re-stocking on a vast scale ; and private industry sought to take part in the movement, and follow the impulse given by a higher quarter. It is known what bitter disappointments followed these first attempts, which appeared to compromise the whole future of the oyster industry. The Marine Department was, however, fully alive to the occasion. The conduct of the administrative duties was entrusted to a man who had set his heart on the success of the cause, and who was not discouraged. The strict observance of the decrees of 1853 respecting the coast fishery may be considered as having largely contributed to the present prosperity. Of these decrees, the wisdom and the timely character of which has been shown by experience, which were intended to stop the pillage and total exhaustion of oyster layings, and which subjected their working to strict and sensible regulations, M. de Bon had laid the foundation by his reports and experimental operations.

The continuous application of these measures, the ever-constant attention, the encouragement and even example which the Marine Department never ceased to exhibit, ended in bringing about the re-stocking of the natural beds which seemed on the point of being destroyed, and in awakening a simultaneous spirit of progress in private oyster culture.

The latter, taught by its own experience, and the experiments carried on by the State, has improved and almost perfected its methods. After a rapid recovery, it is now seen in a state of prosperity, which, while remunerative to the workers, is not wanting in profit or honour to the country at large. It must, however, not be forgotten that administrative supervision is now as useful to it for the

continuance of success, as the care and encouragement of the State were necessary at first for preparing its path and directing its first steps.

In the course of this Report I shall have to bring forward contradictory facts ; practically divergences in the application of methods occur at every step. These result from a variety of circumstances. Methods must not be inflexible : they should be capable of modification, if worth adopting at all, to suit different natural conditions. Those conditions vary necessarily with the locality, the climate, the nature of the soil, the character of the water, the direction and intensity of submarine currents, &c.

Some points in this extensive practical study require undoubtedly separate examination and study, but this Report, the object of which is merely to state the actual condition of ostriculture on our coast, is not the proper place for their enunciation or discussion. Whilst making from time to time certain special remarks, I shall, therefore, limit myself to reporting on my mission, in the order in which I have complied with it, and to describing the state of this industry at each place as I have found it.

COURSEULLES-SUR-MER.

In the vicinity of the natural banks of the Channel and of the oyster bed of Dives, at the mouth of the river Seulle, from which it takes its name, Courseulles is one of the points on the coast of Normandy where the ostricultural industry is practised with success and profit.

The shell-fish brought from this station has now for a long time enjoyed a well-earned reputation in our markets.

Courseulles is not, however, a breeding ground. The parc owners (*parquers*) who have established ponds, own, at Saint Vaast-de-la-Hougue, preserves intended for the

rearing and growth of oysters, and the ponds of Courseulles-sur-Mer only serve for fattening and preparing for transport. The oysters which are the object of cultivation come as a rule from the Channel banks, from which the fishermen bring them for delivery to the dealers. These oysters would not be so much valued by consumers if they were not previously submitted to a special training, which is the proper occupation of the parc-owners at Courseulles. The object of this training is to impart the qualities upon which the reputation of these oysters is founded, viz., delicacy of taste, cleanness, and fitness for standing long journeys without loss of freshness.

The parcs of Courseulles are dug out beyond the dune, or sandhill, and are kept in communication with the sea by the mouth of the Seulle. Arranged symmetrically along the banks of this watercourse, they are connected with it by channels, through which the fresh sea water flows in in every direction twice a fortnight, for several days consecutively.

Each parc is provided with a floodgate, which serves to keep in the water or to empty the reservoir as the tide falls, or again to afford a passage for a fresh supply of water when it is desired to fill the basin. In this last case the flood-gate is not opened, except when the tide has risen above the level of the reservoirs. At this moment, in fact, the water is in its purest condition; prior to the rise the water contains in suspension mud accumulated in the bed of the river, and earthy matters which have been stirred up in the flow and reflow upon the shore.

The parcs which are dug in an essentially clayey soil occupy an area of from 15 to 16 hectares, a space which is capable of future extension. They measure between 80 and 100 mètres in length by 12 in breadth, and about 2

mètres in depth. The sides, which are shelving, form with the bottom an angle of 40° to 45° , and are covered by a layer of gravel from two to four centimètres in thickness.

In the middle of August the oysters of Saint Vaast-de-la-Hougue commence to be brought to Courseulles, as they are wanted, by boats specially kept for the purpose. Those oysters only are brought which comply with the regulation size, for the already advanced state of the season and the nature of the ground render it improbable that they will grow much in their new abode. On their leaving La Hougue, and on arriving at Courseulles, they are washed, sorted, and carefully freed from the mud and vegetation which may adhere to them, and from all parasitic bodies which alter the beauty and regularity of the shell and depreciate their value.

The method of training is very simple. In the first place the oysters are left to recover from the effects of their journey. Then, by means of a rake or even by hand, those meant for sending away earliest are spread on the slopes of the reservoirs; the others are thrown back to the bottom, upon the clay, until their turn comes for replacing the first.

The object is to accustom the mollusc to dispense with a fresh supply of water, and to retain as long as possible the quantity which it keeps in its shells. For this purpose it is allowed to stay in basins, morning and evening, for only half an hour or an hour during the first days. After some time, and by gradually increasing the time for keeping it out of water, it can at last be kept out all night.

Arrived at this stage, the oyster has actually learnt to keep its shells closed, and can be carried long distances without opening or losing its freshness. As regards fattening, no particular care is taken; that process takes place

naturally at a certain time; and further, the parc-owners attribute to the mixture of the fresh water of the Seulle with the sea the peculiar readiness to fatten which the oyster shows here more than elsewhere.

During summer and early autumn the withdrawal of the oyster from the water must end a little before sunrise, and be renewed in the evening, after the heat of the day has passed. At this season, also, the handling must be renewed more frequently, if the oyster is to be prevented from getting milky, which makes it unfit for consumption.

In winter, on the contrary, it is not so necessary to subject the oyster to this *régime* of privation, and frequent changes of position are less indispensable. The temperature being colder, evaporation is less, and the mollusc has not to take in water so often. But if the winter is severe, and the cold threatens to continue, the deposits of oysters are made in the direction of La Hougue, which is less exposed to frost. Courseulles supplies annually 20 to 30 millions of oysters for consumption; they are sold by classes according to size; as "large," "marketable," "fine and small middles," and finally, "pearls." The price varies much, and depends on the success of dredging.

GRAND CAMP.

Grand Camp is, as a station, not less favourable for rearing the oyster than the neighbouring one at Courseulles. But the sea, which is frequently very rough and beats on the shore, renders the establishment of parcs impossible under ordinary conditions. To overcome the difficulties caused by the situation, artificial means were found necessary. Messrs. François André and Febvre have attained the following objects:—

Without giving a separate account of the two establishments set up at Grand Camp in 1874 by Messrs. Febvre and André, it is enough to say that they have been organised on the same principle, and I shall describe more closely that of M. Febvre, on the model of which M. François André has also carried on his work.

Surrounded by high dykes, which shelter it both from wind and storm, and situated at a distance of one kilomètre from Grand Camp, beyond the dune or sandhill, and on low-lying ground, this establishment covers an area of five hectares. It is divided into 32 parallel basins, of which the greater number are 45 mètres long and 15 broad, and 1 m. 5 deep. They are constructed of unmortared stone, and are separated by the pathways leading from one to another. Each basin is provided with a wherry, which the workmen can move about easily.

The water is received from the sea at the old Fort Samson, about 50 mètres from the higher parcs. It can be changed at every tide, and is received into two receptacles, and carried towards the chief establishment by an underground duct, 1 m. 5 in breadth and depth.

The water is distributed by means of strong floodgates, which also keep in the water when the tide goes down. A feeding canal, running the length of the establishment, which it divides in two, carries the water in every direction. The reservoirs are supplied with sluice-taps for letting water in and out. As the parcs have been formed on land having a slight incline, and as they inter-communicate, a current inside can, when wanted, be produced. I should add that several little springs rise in the basin itself and modify the saline qualities of the sea water. The soil is essentially argillaceous.

Between Fort Samson and the establishment are the buildings where are carried on the various manipulations incident to oyster culture, such as separating dredged oysters from one another, sorting, packing, &c. Fourteen women find employment all the year round at this establishment.

It may be asked what is the object of these 32 basins ; what are the methods employed by Messrs. Febvre and André for training in the first stage, rearing, fattening, and greening the oyster ? The two semicircular reservoirs at Fort Samson, which first receive the sea water, are appropriated to the preservation of spat. One portion of one of these two receptacles is used for the experiments to which M. Febvre has applied himself on the artificial fattening of the oyster, according to methods practised by certain American rearers. These experiments have been without result.

The operations which precede the sending away the oysters, washing, and purging, are carried on in an asphalted basin set apart for these purposes in the chief establishment.

In the other parcs the oysters are placed in classes, according to age and size.

All the spat dealt with at Grand Camp comes from Brittany. As soon as it arrives, in the month of April, the young oysters are stuck, to the number of 4000 or 5000, on metallic hurdles, one mètre long and 50 centimètres broad. The use of these hurdles economises the time devoted to cleaning the spat, in order to free it from the mud brought in with it from the sea ; it is enough to take the apparatus by the two handles with which it is furnished, and to shake it gently in the water. After some months the growth is plainly visible, and the hurdles have to be taken away.

But the basins at Grand Camp being too small to hold the quantities of oysters reared every year by M. Febvre, a part of them are sent to St. Vaast-de-la-Hougue, and the rest are shut up in boxes two mètres square, covered with wooden laths, wide enough apart to allow water to enter, and immersed in a parc constructed far enough out in the sea, and yet near the establishment.

When the oysters have reached the saleable size, they are brought back in November to the shore parcs, when they are spread on the ground, or on the hurdles, in order to fatten.

The greening takes place as winter comes on. Then the hurdles get lined with a sort of green moss, the appearance of which is the signal for that colouring of the oyster which takes place here, as well as at Marennes. The oysters coming from the parcs of MM. Febvre and François André may be reckoned for quality and shape with the best. The shell, small, light, transparent, and well rounded, reminds one of the Ostend oyster, which it may also rival as to edible qualities. What above all distinguishes the oysters of Grand Camp is the similarity of taste which they have with the highly reputed and undoubtedly superior oysters of the bank of Guinehaut, a natural bed situated at the mouth of the Isigny river, which is unfortunately far from productive.

To give an idea of the importance of the Grand Camp establishments, I may say that M. Febvre is in a position to supply at this moment 3,000,000 of oysters for consumption.

SAINT VAAST-DE-LA-HOUGUE.

From time immemorial the fishermen of St. Vaast-de-la-Hougue have added to their other employments the rearing of oysters. But with the exception of a few new parc-owners, mostly *inscrits maritimes*, who work parcs conceded by the State, they are satisfied with keeping for a very short time the oysters, which, whether taken by the hand or with the dredge, are the result of the fishing operations of the greater part of the population of this district, who betake themselves to it during the time that fishing is allowed.

On the 1st September the sailors come to the natural banks to fish for oysters. Fishing on foot is only productive at spring tides. It is practised by women and children, who pick up such oysters only as have been detached by the violence of the waves from their native beds.

The oyster concessions of St. Vaast-de-la-Hougue, established on a muddy-clay soil, comprise dépôts or layings and parcs. The first, to the number of 48, occupy an area of $46\frac{1}{2}$ hectares, and extend along that part of the beach called La Couleige: they are reserved for young oysters which have to grow in order to be marketable. The second, set apart for the preservation of eatable oysters, are situate in La Toquaise, and are shielded for the most part from the sea by the little Isle of Tatihou. They number 137 on an area of $39\frac{1}{2}$ hectares.

The dépôts or layings are only uncovered at spring tides; they are bordered by ridges of unmortared stones from 15 to 25 centimètres high. The parcs are enclosed with walls also of unmortared stones from 75 centimètres to one mètre high, and from two to three mètres thick. At the approach of winter, and after the small oysters from the dépôts have been transferred to the parcs for shelter

from the severity of the cold, a layer of potter's earth mixed with straw is placed in the walls, in order that water may be kept in the receptacle at low tide. The covering of water by which the oysters are overlaid keeps them from contact with the outside cold and frosts.

The costs of management are shared by each riparian owner.

The dépôts and parcs are cleaned once or twice a year, it being necessary to clear away the mud deposited by the sea, and the vegetation which springs up.

The oysters with which the rearing succeeds best come from the Bay of Cancale or the bank of Dives. Nevertheless, the experiments tried upon Arcachon and Brittany oysters have resulted favourably.

The rearers of La Hougue consider that the parcing of the oyster should not be for more than two years. The first year it grows from about three to four centimètres ; in the second it grows less, it is true, but it thickens and fattens. The native oysters, that is, those fished within a very short radius, can be kept longer.

The methods of rearing pursued at La Hougue consist chiefly in cleaning and frequently changing the places of the oysters, in order to prevent their being buried in the mud or covered by parasitic sea-weeds, which attach themselves to the shells, prevent the oyster from opening, and finish by stifling and killing it.

In the parcs these manipulations take place two or three times a month, or even oftener, according to the quantity of earthy matters deposited by the sea and the abundance of marine plants. During the winter it is less

necessary to do this frequently ; for, independently of the difficulty which there is always in working at that season, the hair-weeds, which are most prejudicial, have disappeared.

The young oysters growing in the dépôts are not subjected to any treatment during the six or seven months that they stay there. The dépôt being situated pretty low in the sea, the water covering them is purer, and algæ are scarcer. Nothing more is done than to wash them, on their being put into winter quarters and on bringing them out again.

I should repeat here an observation made by certain rearers at St. Vaast-de-la-Hougue, that certain parts of the grounds worked became unsuitable for keeping oysters, and seemed exhausted. There are some persons who, to remedy this state of things, have taken the step of giving their parcs rest for a year, in order to leave these aquatic fields time to improve, and to some extent to recover. I should add that they have had reason to congratulate themselves on this resolve.

It is necessary now to enter into sundry details, to discover the many causes which may have combined to produce this exhaustion. The two principal ones are the following :—1st. The overcrowding of too large a number of oysters in the same parc. 2nd. The incessant rising of foetid mud formed by vegetable matters in decomposition, which the water carries in every direction. In the first case the oysters receive but insufficient nourishment ; insufficient, because if in a given quantity of water there is only nourishment for 1000 oysters, 50,000 cannot find their food there, and thinness and sickness are the necessary consequences.

In the second case poisoning causes death ; but I hasten to state that this condition of the parcs at La Hougue has been much exaggerated, and affords no cause for alarm. I am, on the contrary, very happy to affirm that the importance of the oyster industry goes on increasing constantly. The industry is about to make new increased efforts. Many abandoned parcs have been taken again, and are now prospering. It will be enough for me to say that 300 persons find occupation every day in the concessions of St. Vaast-de-la-Hougue, and that this number is at least doubled at every spring tide.

GRANVILLE.

It is on this part of the French coast washed by the Channel, and between St. Malo, Cancale, Granville, and Régneville, that our richest natural deposits lie. In the neighbourhood of Granville alone we count the banks of La Forraine, Haguet, Trou-à-Girou, Saint Marc, Bout-du-Roc, St. Germain, Géfosse, Sénéquet, La Cortaise, Le Ronquet, Le Pirou, 11 natural banks in all.

It would be difficult to estimate the number of inhabitants on this coast who get their living by the oyster fishery : it is considerable. Still it has sensibly diminished for some years, as the fishery is less productive than formerly.

With a view of competing with English fishermen in the working of the open sea, fishermen living near the Granville and Cancale banks were authorised to break the rule which restrained them from ever staying out at night with their boats. It resulted that under pretence of dredging concurrently with the English on the common grounds, they worked in preference upon the oyster-beds reserved in the territorial waters, and ruined them.

Wise measures have been taken to prevent a recurrence of these depredations.

Thanks to assiduous watching ; thanks to the power left to the Maritime Administration to forbid fishing at any given place during one or two years, if the necessity for such prohibition has been recognised by the Commissions charged with ascertaining the state of the oyster-beds ; thanks, lastly, to the district where it is absolutely forbidden to fish, which the State has decided to reserve, and from which reproduction radiates upon all neighbouring places, the oyster-beds are now reviving.

Certainly this work of revival cannot be entirely accomplished in so short a time. In spite of the extraordinary fecundity which the oyster possesses, it is necessary that the places where the spat is about to fall should present the conditions indispensable for its development. Now these conditions are not always found on banks exhausted by reckless fishing. We must wait for them to be reconstituted and renewed.

The ostricultural industry, properly so called, is carried on at Granville in 85 *parcs* of deposit, which serve only to shelter the oysters fished on the neighbouring banks, till the time when the rearers from Courseulles and La Hougue, who usually purchase them, come to take them away.

These *parcs* are all bounded by a double fence, from 70 to 80 centimètres high ; the space between the two fences is filled with a layer of potter's earth, mixed with straw, or with mud only. This arrangement is intended to prevent the oysters placed in the *parcs* from being carried away and dispersed by the sea, and at the same time to keep in the water at low tide to shield them from the effects of heat and cold. I should add that the sea is so often

rough at Granville that, though there are in the neighbourhood inexhaustible centres of reproduction, it would be very difficult to fix collecting apparatus on the shore.

REGNEVILLE.

Though at no great distance from Granville, the station of Régneville is very favourable to the rearing of the oyster.

It is to be remarked that the circumstances of position are different. Near the head of the angle formed by the coasts of Normandy and Brittany, there opens up an immense haven which begins at Point Agou and stretches along the beach, where Régneville has been built. The rising sea covers it at every tide. The Sienne, a little river of fresh water, taking its rise at La Baleine, falls into this bay, and mingles its waters with the sea, the saltness of which it tempers, and gives it that quality so prized and sought for by ostriculturists which I have already noticed in speaking of Courseulles.

It is just below the mouth of the Sienne that the ostricultural establishment founded by Madame Sarah Félix, of which I am going to give a short description, is situated.

I shall pass by with slight remark some ancient parcs, unworked from the time that the fishermen have taken the product of their fishery elsewhere, as well as some still older dépôts now abolished, and formerly known by the name of the parcs by the Passevin brook. These dépôts, carried on in the style of those at Courseulles, had no object but that of giving shelter for a longer or shorter time to oysters gathered by the fishermen of the place, who disposed of them to the owners of these ponds. The dépôts were fed by an underground canal communicating with the sea, and supplying water at high spring tides only.

Before Madame Sarah Félix established herself here, no serious attempt at rearing had been undertaken at Régneville.

The parcs belonging to Madame Sarah Félix, dug out on calcareous soil, occupy on the shore an area of five hectares. A dyke which cannot be submerged, with a height of six mètres, made of earth taken from the inner basins and strong rock work, protects them from the attacks of the sea. The side facing the open cannot be mined or worn away, being protected by great stones, against which the sea breaks.

An open canal, which starts from low-water mark and leads up to the establishment, introduces the water. On its arrival, the water is received and distributed through a strong floodgate worked by cranks, and of which the low level is several feet lower than dead low water. It was indispensable to adopt this arrangement, in order to prevent any but perfectly pure water getting into the reservoirs at high tide. All along the haven there is a quantity of sand that the sea raises when sweeping the shore.

A principal feeding canal traverses the establishment, and distributes fresh sea water to 24 basins, measuring about 3·5 mètres in depth, and capable of holding 2·5 mètres of water.

Each receptacle communicates with the canal by a small floodgate, for letting out and keeping in water.

A rather abundant spring, rising in the vicinity of the property itself, serves to temper the saltness of the water.

What have been the results obtained in the Régneville parcs ?

After various preliminary experiments had shown the possibility of practising the rearing and fattening of the

oyster with success in the parcs which she had organised, Madame Sarah Félix made, in 1865, attempts at reproduction from captive oysters.

Adult specimens taken from the banks of La Cortaise, which supply the finest and most esteemed products of this district, were placed in a receptacle where collecting apparatus made of boards and tiles had been arranged. At the usual season the oysters emitted spat, and the spat was on the point of adhering to the collectors. If the result was not quite a success, for it was perceived during the experiment that the basin was wanting in depth, and that the water in it was not changed often enough, it was at least very encouraging.

A large number of young oysters which had been successfully preserved soon attained, even upon the collectors, a wonderfully quick growth.

Soon after, new experiments were made upon 100,000 oysters. Osticulture was then fresh, and the preparation had not been discovered with which to line the collectors, in order to facilitate the *detroquage* or separation of the oysters attached to them. To remedy the difficulties which had been encountered, a paper, lined with a thin layer of cement, was applied to the tiles. It thereupon became easy to detach the young oyster from the place where it had stuck. In addition, a suitable means was provided for the regular feeding of the basin.

The success was complete. The collectors were covered with spat, the separation of which was easy; and the further development of the new generation, bred in the Régneville parcs, was accomplished under the most favourable conditions.

During a considerable time the parcs, which required expensive works and new means of carriage, were somewhat forsaken. In 1873 M. Vallé had placed there for rearing and fattening 83,000 young ones, coming from Vivier-sur-Mer, and of a size of about two to three centimètres. One year later 65,000 of these oysters were disposed of for consumption, when they had attained the size of from seven to eight centimètres.

Since this, Madame Sarah Félix has had improvements which she had decided on, carried out, which allow of having a fresh supply of water in the establishment at each tide, which was not possible until the level of the floodgate had been lowered, and the parcs had been deepened. There is room to believe that these happy alterations will cause this fine establishment, the first of its kind, to satisfy the legitimate hopes that the first successes have given rise to.

I shall conclude as I began, by expressing again the opinion that the Régneville station offers all desirable conditions for becoming an important place for ostricultural industry, not only because of its situation, but also because it combines all natural elements of prosperity for the carrying on of this industry. The grounds which might be brought into cultivation are enormous, and their working would be easy and lucrative.

CANCALE.

Among the most justly appreciated products of ostriculture, the oysters of Cancale take one of the highest ranks. They are distinguished at once by their flavour, and the beautiful shape of their shell, and its depth. The fish is thick without being coarse. It keeps fresh several

days, and retains for some time the sea-water which its shell contains. These qualities are due to the origin and the kind of oyster as much as to the methods of rearing.

The methods of training in use at Cancale are like those employed by the rearers of La Hougue.

The oyster-beds of the Bay of Mont St. Michel, from which these delicate oysters come, are the most fertile in the Channel. They comprise the banks of Corbière-ô-les-Chaudières, Le Bas-de-l'Eau, Le Vivier-ô-le-Mont, L'Orne-ô-le-Moulin, called La Raie, Saint-Georges, Le Beauveau-ô-le-Mont, and finally, the unassigned part of the bank, which the State has constituted a reserve, and which serves as a demarcation between the beds of the districts of Cancale and Granville.

Cancale is not merely a place of deposit; the rearing of the oyster is also practised there from the time that it is gathered on the open banks, or gleaned upon the beach by fishermen, until the moment when it has acquired the properties which cause it to be sought for our tables.

The conceded grounds spread over an area of 172 hectares; they are distributed into 1276 portions, and divided into parcs and layings. The former are situated rather low in the sea, and their fences are covered every year with spat. The little oysters, whose size prevents their being offered for sale, are put here to grow. In the parcs adult oysters are kept and fed. All the concessions are bounded by a double palisade, which saves them from the ravages that the strong current might make. There exist in the whole Bay of Mont St. Michel two elements of destruction, against which the parc-owners must constantly struggle—wind and mud. The winds from the open, the violence of which is such that the oysters are often carried

from one parc to another, or dispersed in the channels, generally blow during the winter, and considerably multiply the daily cares which attach to the maintenance of the ponds. Mud and sand are increased by the roughness of the sea.

At each tide, when practicable, the rearers must visit their parcs, and proceed with the cleaning, the necessity for which perpetually recurs. Four thousand persons are daily employed at this work.

The oysters stay little more than two or three years at Cancale, that period being enough for them to develop into a saleable size. The rearers have no interest in keeping them longer.

In addition to the oyster merchants, properly so called, who take advantage of the provisions of Article 338 of the Decree of the 4th July, 1853, to obtain concessions by means of a ground-rent levied by the administration of the domains, many *inscrits maritimes* carry on the oyster industry on their own account.

Those least well off are contented to keep for one season the oysters that they have fished on the banks, and those that their families pick up on the beach.

Before the administration of marine had applied the protective measures which are the safeguard of our oyster beds, the fishery on foot became less and less productive. Now it is practised by caravans composed of 500 to 1000 persons, both women and children, who find a sure means of existence by it.

I have still to say a word about the attempts undertaken under the auspices of the administration to collect, in spite of the state of the sea, the spat which every year escapes from the oyster beds.

The parc which the administration has set apart for these experiments measures 40 mètres in length by as much in breadth. The side looking to the sea and the corresponding side are quite open, in order that the waves bringing the embryos may circulate freely inside ; the two other sides are defended by palisades. Tiles arranged in hives (*ruches*), fascines of birch tree, and schistous stones, have been employed as collectors. The brood has adhered pretty freely, but in winter the sea, driven by the strength of the currents, has detached from the collectors a large portion of the young oysters, which had fastened on them. The object of the administration, which wished to prove that the spat was as abundant at Cancale as at Le Vivier, and that it was possible to collect it, has been attained ; private enterprise will do the rest.

It is needless to say that the measures of surveillance taken by the marine for the preservation of our banks, shelter at the same time the parcs from the cupidity of marauders. Besides the ordinary police trained by the agents of the administration, seven guards paid from the funds of the treasury belonging to the layings, two general guards, to which the treasury of the community of fishers allows something, and four sworn guards nominated and paid by the marine, are employed upon this watch.

I should also mention that a syndical commission, composed of the commissaire of the *inscription maritime* as president, the mayor of Cancale, the inspector of fisheries, the syndic of the seafaring people, the treasurer of the community of fishermen, a park guard, and a guard of layings, fixes each year the rating to be paid by the concessionaires of the parcs and layings, the sum of which goes to cover the common expenses of working, such as allowance to guards, maintenance of roads, channels, &c.

Finally, I have had the pleasure of proving that almost all the concessions are worked. Ten years ago half the parcs had been abandoned.

LE VIVIER-SUR-MER.

Founded under conditions analogous to those of Cancale, the parcs of Le Vivier-sur-Mer date no further back than seven years. Before that time fishing was almost the only industry in which the population were engaged. The foreshore at Le Vivier is very like that at Cancale; there is the same muddy soil, which is, however, rather more calcareous; the sea is equally violent, and there are the same difficulties in resisting it; but the methods of working differ, and at Le Vivier-sur-Mer reproduction is the main object. Rearing on collectors is, however, successful there, and it would even seem that the coast in this locality is more favourable to the rapid growth of the mollusc than that at Cancale.

Before entering upon the details of the training of the oyster, I shall mention in a few words how ostriculture has been introduced into this locality. The attempts at reproduction made at various points on the coast had attracted the attention of some persons, who undertook to collect the streams of spat which the oysters give off in the spring, and which until then were hopelessly lost through settling on muddy ground.

The first collectors placed on the shore of Le Vivier were owned by M. Barbet: they consisted of schistous stones, and fences placed in the main current.

This first attempt was tolerably successful. The following year M. Meury de Villers, having obtained from the Ministry of Marine, which wished to encourage these attempts, the concession of one hectare of land, organised

parcs and arranged in them cross-pieces of wood ; schistous stones, inclined in the shape of a roof, of volume large enough to resist the current ; and fences, which were not very close, of from 3 to 4 mètres in length and 0·6 mètres in height, completed the arrangement.

This year the harvest was abundant, but the cold and frosty seasons which followed, and the sea, under the influence of wintry storms, destroyed a part of the crop, and the frost added to the disaster.

Those oysters alone were preserved which were fixed at the bottom of the schistous stones, and they furnished remarkable specimens in point of form, quality, and growth.

Many other persons saw, in this first attempt, a ground of hope, rather than discouragement. The sea, though often in a state of disturbance, is not always so, and frosts rarely coincide with the spring tides, by which alone the parcs of Le Vivier are laid bare.

New concessions were sought and obtained, and the shore of Le Vivier was quickly covered with parcs.

The sad winter of 1870-71 was still more destructive, but failed to stop the progress of the rising industry. The collectors retained so little spat that many parcs owners abandoned their operations ; but the following years brought abundant returns, and this ostricultural station of but yesterday's creation has a cheering prospect as a place for reproduction.

The parcing of oysters is very difficult, if not impossible, at Le Vivier ; and the oysters are left to grow on the collectors until the time of sale.

Fascines and schistous stones are the only collectors employed, but Mme. Sarah Félix has advantageously substituted for the old apparatus a new machine made of pieces of slate, which is generally immersed between 15th

June and 15th July. The fascines must be often changed, for the sea quickly destroys them; barnacles (*cravants*), also, which abound on this part of the coast, cover them in spring and make them unfit for retaining the spat. These parasites are not the only enemies to be encountered; mussels, which are a far deadlier foe, come in such quantities upon the parcs of Le Vivier that they form on the ground a layer of from 15 to 35 centimètres thick.

There is neither time to bury them, as is done at Ile d'Oléron, nor to gather them, though they are edible. The reason is that the parcs of Le Vivier are situated very low in the sea, and as they are only uncovered at low tides, the interval between the ebb and flow is employed in detaching the oysters, in picking up those which fall to the ground, and in strengthening or putting the palisades into good condition. In these few hours it is hardly possible to get day labourers together to attend to the most pressing wants.

The oysters in the parcs are estimated at five millions; the result is small, but we must not lose sight of the results of the winter of 1870-71, and the discouragement which naturally followed. It is also to be remembered that Le Vivier-sur-Mer was ten years ago absolutely unknown as an ostricultural station.

As regards the growth of the oyster, it is really marvellous at this station, and I have during the whole course of my inquiry seen only one, Les Sables d'Olonne, which can be compared to Le Vivier in this respect. I have myself taken from a fascine an oyster of 14 or 15 months old, which did not measure less than 7·8 centimètres.

It remains to say a few words about a happy transformation brought about by M. de la Gervinais. The salt

water runs every tide into a millsluice, in which oysters have been laid to fatten, and the fresh water of a small brook is also emptied into the sluice.

In this particular spot the development and growth of the oyster has taken place with marvellous rapidity, and this phenomenon is attributed to the fresh water, the presence of which is very favourable, and above all to the numerous elements of nutrition brought by the brook.

FOSSEMORT, NEAR SAINT MALO.

In 1873 M. Camac obtained a concession from the Minister of Marine, of 3 hectares on the River Rance, near Ménéhic. The Rance formerly contained several oyster-beds, and more recently, as I said in the introduction, M. de Bon succeeded in re-establishing some oyster-beds. At first M. Camac had little success; but the more numerous the obstacles, the more obstinately did M. Camac, who is an American, set to work to overcome them.

The upper part of the area worked rises in the shape of an amphitheatre. It is 150 to 200 mètres from the bed of the river, and the sea covers it at every tide, except during neap tide. It was here that the first *claires* were excavated, measuring 40 mètres in length by 10 in breadth, and 0·6 in depth, which served for the first experiments.

The oysters and spat employed came from Auray. On arrival, the spat already adhering to collectors was detached and enclosed in cases of galvanised wire placed in the *claires*. The oysters of 18 months' growth were enclosed in similar cases, and were put into deep water.

The spat made no progress during the summer; the cold of winter carried away the greater part, but the oysters on the bottom prospered. In the month of October the

cases containing these latter specimens were taken into the upper basins, which, as I have just said, are uncovered, and receive the sea at almost every tide. There they soon got fat, and became green, but as winter set in, sickness carried them off. The summer was not more favourable, and out of 15,000 "young oysters," scarcely 3000 survived.

This series of mishaps disclosed certain facts which did not escape the observation of M. Camac. He concluded that the upper part of the area of his operations did not afford the conditions necessary for the growth of the mollusc. Having tried, without satisfactory results, to alter the character of his cases, he determined next year to place all his "young oysters" at the edge of the river, on a point which is left uncovered only at spring tides, and at a depth of 30 mètres at high-water.

At the following spring tide it was seen that the oysters had visibly progressed, and by the month of October they had attained a size exceeding expectation.

Three thousand spat were sent last year from Auray, to Fossemort; the tiles upon which they were fastened remained in the *claires* up to April of this year, when the separation of the oysters was effected. The spat was divided among 350 cases for oysters set up in the lower part of the concession. Every month these cases are inspected, and the mud which has deposited itself inside, and the marine plants which, by sticking to the wires, impede the circulation of the water, are removed.

At the end of the month of August of this year the growth rose from 2 to 200 $\frac{1}{2}$.

In spite of all the losses sustained in former years, M. Camac expects this year to deliver for consumption from 270,000 to 300,000 oysters measuring 7 to 9 centimètres.

Fosse-mort belongs, both as regards methods and climate, to the Norman group of ostricultural stations. Before proceeding further to take up the coast of Brittany, I shall try to summarise the impressions which the establishments which I have already passed in review have left upon me, I should say that these establishments are really part and parcel of one another. Each station corresponds to one phase in the rearing of the oyster. Le Vivier produces the spat, Grand Camp affords the rearing in the first stage, at La Hougue and Cancale the oysters grow and fatten, and Courseulle prepares them for sending away.

BREST.

The maritime district of Brest is the one which contains the greatest number of oyster-beds, but, as everywhere else, these natural banks were at one time exhausted by the improvidence and cupidity of the fishermen. Speaking only of the Bay of Brest, where formerly 27 could be counted, it appears from official documents (the communication of which I owe to the kindness of the *commissaire-général*, M. Dauriac), that at present only 17 remain, and of this number there are only six in which any traces of reproduction are met with. M. Coste ascertained this deteriorated state of things, which was far advanced even in 1857, and with the view of remedying it, he caused a large number of fascines to be laid down in the bay, but the sea carried them all away, and the attempts were abandoned.

Is it fair to say that the fishermen were the sole authors of this destruction? Without doubt they had the greatest share in it, but natural circumstances, to a certain extent, helped to complete it. The piercing whelk (*murex*), so formidable to the bivalve of which I speak, at one time

infested the greater part of the oyster-beds in Brittany, and caused incalculable damage ; many beds were even wholly destroyed.

In the Bay of Brest another cause was added to the foregoing, namely, that in some years the grounds were overgrown with red seaweed, a marine plant most inimical to reproduction. There are, however, always some compensating agencies at work. At the same time that the grounds were covered with red seaweed, masses of *maërl*, a sort of coral, formed in the vicinity of the old beds, and young oysters were afterwards found attached to the calcareous arborisations which were pulled up. This fact indicates either the reconstruction of the old oyster-beds or the formation of new ones.

I must not omit to note how difficult it is to watch the oyster-beds in this small area of the sea. The Bay of Brest, which is not less than 40 miles in extent, is bordered by creeks, where marauders, warned by their comrades on the watch, can seek a refuge from the pursuit of the fishery guard. Provided with light boats, which draw but little water, and possessing a perfect knowledge of all the creeks and windings of the coast, they speedily find refuge in spots where the boats of the State cannot reach them. The Administration of Marine has used all its influence to persuade them that fishing without moderation nips the coming harvest in the bud ; but the facilities which the railroads offer for the rapid and easy transport of the fruit of their marauding have prevailed over these wise counsels. Coercive measures have been powerless to repress their rapacity.

Such was the state of affairs a few years ago. At present it is a little better. The number of marauders is

also smaller, for now they no longer find the means of subsistence in the exercise of their unlawful employment.

From an ostriculturist's point of view, the Bay of Brest would seem wonderfully favourable for his operations. But the sea is exceedingly rough in bad weather, and rapid currents cross it in all directions. People recollect, too, how unfortunate and useless were the efforts made there by M. Coste in 1857. From that time no one has dreamt of working these shores, the waters of which are apparently so beautiful and tranquil.

In 1874, a more determined man, M. Thomas, an engineer, imbued with new ideas as to the method of collecting the spat at a great depth, as to the development, rearing, and parcing of the oyster, obtained from the Minister of Marine the concession called Moulin-Blanc. This part of the bay receives a little current of fresh water, which can be utilised with great advantage. M. Thomas established parcs there, and stocked them with oysters. The experiments commenced rest solely on theories of his own ; they are still too recent for us to be able to appreciate the result. Hitherto this gentleman has conducted his experiments more as a scientific than as a commercial man. He has studied the Bay of Brest, its water, its ordinary temperature, the winds which usually prevail there, the currents which traverse it ; in fact, everything from which he can expect to derive any advantage. He records with care the observations of each day, and I sincerely hope that so much trouble will not be in vain, both for this indefatigable inquirer and for the science of ostriculture.

BELON, NEAR QUIMPER.

The establishment created by MM. de Mauduit and de Solminihac in the River of Bélon is one of the most interesting of those I have visited in the course of my mission.

This concession comprises about five hectares. On one side it extends along the right bank, and includes on the other a vast estuary in the shape of a horseshoe.

I have rarely met with oysters artificially raised, or even oysters caught on the banks, so beautifully shaped, or of so exquisite a taste. The shell is fine, thin, transparent, hard, and well-pearled in the interior. It shows on the outside marked but delicate indentations, a characteristic indication of a vigorous growth as well as of the perfect health of the oyster which it encloses. There are many reasons which insure to the establishment at Bélon the highest pre-eminence, quite apart from the actual value of its productions. They are simultaneously owing to the exceptional situation of the establishment, to the favourable nature of the soil, to the influence of the currents, to the composition of the waters, and to the exceptional and enlightened care which is unremittingly bestowed upon the young oysters.

Four kilomètres from the common mouth of the River of Pont-Avon and of that of Bélon, the parcs of MM. de Mauduit and de Solminihac are constantly being washed by the waters of the ocean, which become aërated by breaking against the rocks which skirt this wild and picturesque coast. Their situation presents the same advantageous conditions as the ground in the open sea, where the natural oyster-beds lie ; further, they are sheltered from storms.

The bed of the river is composed almost entirely of sand mixed with shells, and is very rich in calcareous matter. The flux and reflux of the ocean, while causing an incessant agitation in the water, give rise to perpetual currents.

The concession is divided :—First, into *parcs*, in which are placed the cases containing the spat, and which are only uncovered at spring tides ; they are generally situated in the lower parts of the river. Secondly, into *parcs*, where the adult oysters are spread to make them grow, thicken, and fatten ; the ground on which the adult oysters are placed is every year improved by the deposit of a load of shelly sand containing 80 per cent. of calcareous matter. Thirdly, into basins, capable of submersion, which receive the water at each tide, and are intended to shelter the cases during the winter, and serve equally as *depôts* for the marketable oysters which are being prepared for sending away ; these basins communicate with each other, and can be easily emptied and cleaned at low tide. Lastly, in a large reservoir, which cannot be submerged, constructed in a bend of the river, are enclosed other cases and cemented basins, suitable for preserving and rearing the oyster.

The spat comes from Auray, from the *parcs* of reproduction situated at Fort Espagnol, belonging to MM. de Mauduit and de Solminihac ; on its arrival it is poured into oyster-boxes, which remain at 25 or 30 centimètres from the bottom, on pickets driven into the ground, and also on cross-pieces of wood secured by stakes.

The spat remains in the cases in deep water from the month of April to the month of October. It is transferred to the reserve basins for the winter, and in the spring is spread on the bottom of the *parcs* for fattening.

The average yearly growth of the oyster varies between three and four-and-a-half centimètres ; with the adult oyster it is rather less, but attains from two-and-a-half centimètres to three-and-a-half centimètres. This depends greatly upon where the oysters come from, and the parcs in which they are placed ; the oysters from Quimper grow the most rapidly. As to the dredged oysters found at Auray, many of them become sluggish, and make no progress during one season, but they make up for lost time in the following season.

The oysters in the cases are left untouched during the fine weather ; too frequent interference with them would probably lead to breakage of the recent formation. Before placing them in winter quarters, they are passed through a sieve, in order to classify them according to their size. The spat and the little dredged oysters undergo this sorting, in order that the oysters in the same case may all be of the same size.

The oysters ready to be sent to the market are laid flat on the ground, and are frequently shifted about and cleaned. The workmen employed in this branch take the opportunity to fill up with sand the inequalities caused either by the flow or reflow of the waves, or by crabs, and in this way the oysters lie only on perfectly even ground.

MM. de Mauduit and de Solminihac have observed some interesting phenomena in their parcs, which deserve notice in this Report. With regard to the adult oyster, the fattening of which is desired, they have remarked that the oftener it is shifted the more it increases in size. They have also perceived that the oysters in cases develop mainly in size ; in the parcs, on the contrary, they develop

in thickness. Lastly, they have proved that the nearer the oysters are brought to the channels where the currents are continuous, the more they gain in size.

Some attempts at reproduction made in the upper part of the concession, in the neighbourhood of some parcs filled with oysters, have not been unsuccessful. This year, on each tile could be counted from 70 to 80 spat. MM. de Mauduit and de Solminihac began at Bélon not more than five or six years ago, and in spite of imperfect knowledge, and the deceptions inseparable from first attempts, they are in a condition to deliver for consumption two-and-a-half millions of perfectly beautiful oysters, while preserving six-and-a-half millions in their parcs. They have, moreover, benefited their country by the spectacle of a model ostricultural establishment, and dispelled many prejudices, by utilising lands which a few years ago would have been considered unfit for the cultivation of the oyster.

LORIENT.

The natural aspects which are found at Lorient show that the oyster industry can flourish there.

The Blavet, or River of Hennebont, which falls into the bay, contained not long ago oyster-banks which yielded choice oysters ; it was evident, therefore, that the mollusc could obtain in this bay what it requires. At Kermélo, on the River Ter, in a spot situated a little below Lorient, MM. Charles and M. Turlure have founded their establishments.

After having tried unsuccessfully to collect the spat furnished by the oyster-beds of the River Hennebont, MM. Charles directed their operations in another channel ; the rearing and fattening of the oyster was the end which they desired to attain.

The Ter is a river with a muddy bottom ; it is far from wide, and at low water of spring tides nothing remains but a narrow channel ; the grounds which can be utilised are consequently very limited in extent. A reserve pond, situated a little above, allows fresh water to escape into the river.

Before deriving any profit from this part of the maritime domain, considerable difficulties have to be surmounted. Before thinking of laying down oysters on this moving mass of mud, it was necessary to consolidate it. MM. Charles succeeded in making the soil solid, by spreading gravel and sand over their concession.

M. Turlure attained the same result by other means ; thinking that the work of consolidation on his concession would involve too great expense, he adopted a system of cemented basins, invented by M. Michel, an engineer, which permitted him to utilise all the projecting (*emergentes*) portions of his parcs.

These basins, which are 50 centimètres in length by 30 or 40 in breadth, and are arranged in rows, between which space is left open for working the parcs, present this advantage, that the oysters enclosed in them cannot be injured by the variations of temperature, for they retain a depth of from 10 to 12 centimètres of water when the tide goes down.

The Oyster Society, of which M. Turlure is the director, possesses 60,000 of these basins. The capacity of these receptacles varies with the size of the oyster in the first stage, and during the first year each basin will contain 300 ; in the second, 150 ; in the third, 75.

These parcs are not the only ones established on the ground worked under the management of M. Turlure. At the back of the workshops and warehouses two large

asphalted basins, of 80 mètres in length by 21 in width, serve as *parcs* for reception of oysters, for sending them off, and for their preparation for travelling. They are divided into seven compartments, in which the oysters are classed according to their size and origin. They communicate with the river by a canal, and the water in them can be renewed when required.

For some years this establishment has enjoyed a real importance; from M. Turlure's own statement, there are 10 millions of oysters in the *parcs* and rivers taken together.

The establishment of MM. Charles, as described above, is completed by other basins dug out above the river, beyond the dune which divides private properties from the public maritime domain. A canal between the sea and the *parcs*, at the extremity of which is a floodgate, serves to distribute the water which supplies this establishment, and which can be renewed nine or ten days out of fifteen.

The basins are not all used for the same purpose; one is set apart for those oysters which are undergoing purgation and fasting, as a preliminary to being shortly sent away; others contain cases and metallic hurdles, on which the spat, or even oysters on the point of becoming eatable, are spread. These same pieces of water also serve to shelter the spat reared in the river during the winter season, when severe cold is apprehended.

Although the reservoirs communicate with each other, and are supplied by the same water, yet they give different results. In one, the furthest from the mouth of the channel, the bottom is composed of mud and clay, and in it the oyster easily gains from 450½ to 500 in a year. The neighbouring *parc*, which is only separated from the other by a narrow strip of land, can scarcely nourish the oysters

placed in it. These are anomalies which may be explained by the larger or smaller amount of food which emanates directly from the soil, and by numerous oozings of fresh water into the parc where the development of the mollusc is so marked.

MM. Charles sold, in 1875, 5,500,000 oysters, of which 2,500,000 were fit for consumption. The spat which is reared comes from Auray, and I will add that they produce in the basins of Lorient specimens which are distinguished by the delicacy of their taste, and by the fineness and lightness of their shells. I have seen a great number of them that yield in no respect to the oysters of Ostend.

Auray and La Trinité are, with Arcachon, the most important oyster centres on our coast. Reproduction is the great object at these places. The oyster-bed in the River of Auray is no less than three leagues in length; it extends from the mill of Poulben and from the chapel of St. Avoy, as far as the canal of Coat-Courzo, and forms an uninterrupted chain of banks, occupying an area of more than 300 hectares.

In the neighbouring River of La Trinité, which is also called the River of Crach, are likewise found numerous oyster-banks, but of less extent.

Ostriculture in this part of Morbihan dates back a dozen years. The development which has taken place must not be attributed solely to private enterprise. Government has had a considerable share in it. The application of legislative measures met with much hostility from the fishermen, but the first thing to be taken into consideration was, naturally, the preservation of the beds, which were being pillaged without restraint and without discretion. What would have become of the oyster industry at Auray and at La Trinité if those banks which, at the present

day, form the wealth of the parc-owners, had disappeared? As M. Platel, who has written a very complete and exact paper on Ostriculture in Morbihan, from which I have borrowed very valuable information, judiciously remarks, we cannot too often remember how much perseverance and care it required on the part of the Maritime Administration in the districts of Lorient, Vannes, and Auray, to save the wrecks of that wealth which is disseminated in the Rivers of Morbihan.

My report on Auray would certainly be incomplete if I did not render a tribute to the devotedness of the Commissaire of the *Inscription Maritime*, M. Coste, whose praise is in every mouth. This honourable functionary, prompted by the spirit of the administrative instructions, encourages and advises on every side.

It would be impossible for me, in this short statement, to pass in review all the establishments on the River Auray. I will therefore take as a model one of the most complete and best organised with regard to reproduction, and the one which I have perhaps studied the most; it is the establishment of M. de Thévenard.

The seat of the works of M. Thévenard, Mayor of Auray, is at a place called Le Rocher. This concession comprises parcs of reproduction, and some *claires* for rearing and preservation. These parcs are established, the former on a bottom of mud three or four mètres thick, the latter on a more solid soil. Buildings erected on the banks of the river serve as workshops for detaching, sorting, and liming, and at the same time as places for keeping the oyster-cases.

In front of these buildings, and only a few mètres from low-water mark, *claires* have been dug which can retain water, and in which during the winter is placed the harvest of the season, to preserve it from the cold.

The collectors employed by M. de Thévenard differ according to the nature of the soil. On muddy grounds they are composed of a cluster of ten tiles crossed, one above the other, two and two, suspended on a stake two mètres high. A platform nailed 30 centimètres below the tiles prevents the apparatus from sinking in the mud. This extremely ingenious plan, which allows of placing collectors on all the muddy bottoms of the rivers in Morbihan, was invented by M. Eugene Le Roux, and M. Thévenard has perfected it by adding a second platform above the first.

On more solid grounds the usual hives are used, or else tiles are merely placed one above the other on cross-pieces of wood, sometimes also boards are made use of as collectors. The collectors are plastered over before their immersion. This operation is effected in the following manner:—According to the method of M. Martin, of the River Crach, which M. de Thévenard has adopted, some mud, to which a tenth part of hydraulic lime has been added, is diluted in a large tub of sea-water. It is necessary that this mixture should be sufficiently liquid for it to spread and adhere easily everywhere. The collectors are then plunged into these baths. Three or four hours after, and before this layer is quite dry, the apparatus is again soaked in another tub, in which there is only hydraulic lime and sea-water.

The collectors are put in their places at the commencement of June, the time when the emission of the spat commences, which is sometimes prolonged until the month of August, and even a little later in the River of Bono; they are taken out, for picking off, at the beginning of winter.

M. de Thévenard conducts this operation by means of a barge, on which is fixed a lever, one of the extremities of

which is provided with a cord and a hook, for raising the collectors in the water. This method saves much time, for they can be quickly raised, and in any depth of water. The picking off takes place, if from the board-collectors, in November and December ; if from the tiles, in the month of March of the following year.

The oysters picked off are collected into the oyster-cases before the commencement of winter ; and when there is no longer any reason to fear severe cold, the cases are let down into the river, where growth is more rapid.

ESTABLISHMENT OF LE BRENEGUY.

Not far from the River of Auray, behind Locmariaker, a very interesting establishment has been created by the company of which M. d'Argy is the director. This establishment occupies an area of 45 hectares in the basin of Le Brenéguy. Shut in by the coast, separated towards the west from the sea by a natural dyke which is proof against submersion, it communicates with the ocean by the inlet of Kerlud. Another dyke of 145 mètres, constructed of earth and masonry, and furnished with two sluices, closes the basin on this side, protects it from storms, and maintains in Le Brenéguy the level of high water.

This vast preserve contains 900,000 cubic mètres of water, and its depth varies from one to three mètres. The sluices are only opened at spring-tides, consequently the water is not changed oftener than twice a month. The winds which constantly blow on the coasts of Morbihan keep up the aëration of the water, and prevent its becoming stagnant. The bottom is of granite, covered in some places by a slight layer of mud.

It is needless to say that the oysters reared in this establishment, which was only created two years ago, come

from Auray or La Trinité. The spat is shut up in metallic cases with wooden frames, and the young oysters, which have nothing to fear from crabs, are laid on the ground. The oyster grows rapidly in the basin of Le Brenéguy, and the qualities which can be acquired there are analogous to those for which Bélon is famous.

As at Bélon, oysters dredged and laid down quickly alter, and an advantageous change in the shell takes place.

M. d'Argy proposes to complete the work, already so advanced at Le Brenéguy, by attempts at reproduction on a large scale. My opinion is that this establishment, which can already deliver many millions of oysters for consumption, has a great future in prospect.

On the River of La Trinité, I shall mention, among others, the establishments of Dr. Gressy, to whom are due certain improvements effected in the methods of culture.

The Isle of Cuhan, where he has settled down to work, contains rearing-basins cut in the rocks. Owing to their high situation, they are only watered twice a week. In these basins Dr. Gressy has tried to obtain the greening of the oyster. The end desired has been obtained. But the oysters lost in travelling a part of the colouring which distinguishes the Marennes oysters. The methods of cultivating the oyster are about the same at La Trinité as at Auray.

Nevertheless, in the River Crach, some parc-owners find it preferable to separate their young oysters at the beginning of winter. This premature separation is justified by the fact that the spat grows more quickly in the River of La Trinité, and its shell is strong enough to stand the operation at this time.

Other rearers in this locality have a peculiar system of separation. Instead of merely detaching the spat, they break the part of the tile to which it adheres.

This method has for its object the dispensing with the employment of oyster-cases : 1st, because the young oyster, being protected by this second defence, cannot easily become the prey of its enemies ; 2nd, because the fragment of tile adhering to the shell increases the weight of the oyster, and allows of its being laid in open parcs without being liable to be carried off by currents.

I must also mention the fine basins belonging to MM. Leroux, constructed in full stream and capable of submersion, in which the oysters can be kept till of full age ; those of M. Martin, and the splendid establishment of the Baron de Wolbock. I must not forget the parcs belonging to the Association of Sea Fishermen of La Trinité. In 1869 the Administration of Marine, with a view of favouring the development of that branch of ostriculture, which has for its object the gathering of spat, distributed to this association, as well as to other seamen, *concessionnaires* of parcs who worked on their own account, 150,000 tiles in all. The association prospers, and its commercial importance advances in proportion to its growing success.

The River of Saint-Philibert, between Auray and Crach, the River of Vannes (of which I shall shortly speak), the inland sea of Morbihan, are places fitted for rearing and parcing the oyster. It will be enough for me to refer to the establishments of the Society of Saint-Anne, of MM. Eden and Fardin at Peningtoul, of M. Pozzi, and of M. Leclaire, which are in full activity.

What then is the actual state of ostriculture in the district of Auray ? I can say, without fear of contradiction, that it is in a thriving condition. One thing alone is

wanting, namely, sufficient openings. The stations in Normandy, and the few establishments in Brittany, where rearing alone is carried on, are not sufficient to find room for the hundreds of millions of young oysters which are collected yearly in the two rivers of Auray and La Trinité, which are of inexhaustible fertility. The harvest of spat in 1876 will be even more considerable than in former years.

At first it was considered satisfactory if 20 or 25 embryos stuck on a single tile; now the average number is over 250 to 300. Some tiles even are found bearing more than 1000 specimens.

I shall conclude with some statistical figures which the *Commissaire* at Auray has been good enough to furnish me with, and which will sum up eloquently all that I could now add:—

The total number of oyster establishments conceded and worked is 297, which comprise 277 parcs and 20 *claires*.

During the season of 1875-76, 4,401,400 dredged oysters were placed in the parcs. Their approximate value was 118,425 francs 18 cents.

During the same period 7,538,150 oysters out of these very parcs sold for 202,801 francs. The difference between the number of oysters put in and that taken out is made up by the spat that each parc-owner rears every year.

The number of spat sold during the same time, either to the establishments on the coasts or to strangers, and resulting from the clearing of the tiles, has been 26,176,300, representing a value of 102,385 francs.

In 1874, on collectors comprising 2,580,370 tiles, 110,563,750 spat were born. This is allowing for losses resulting from picking off and from death. Auray under this head is responsible for 66,195,900. There remained in the parcs, on the 1st January, 1876, 97,348,950 spat, of

which more than 60,000,000 were in the Syndicate of Auray. But, without exaggeration, the spat remaining for disposal may be estimated at 120,000,000. The *concessionnaires*, as a rule, complain of little but low prices.

Without counting the associations of working fishermen, and setting aside the cost of labour, which is almost nothing, the number of working days of the staff employed in the parcs during the last season has been as follows:— for men, 35,819 days; for women, 51,709 days; for children, 2150 days; altogether, 89,678 days.

The result of this work is that the natural oyster-beds, kept in good order, well watched, and moderately worked, become more and more fertile, and the fishery on these banks, which it was feared would disappear for ever, has, on the contrary, become more productive.

It should further be stated that, in the case of families willing to work, misery has been succeeded by comfort; and it must not be forgotten that the district of Auray is only commencing this industry.

VANNES.

Before the gathering of spat had become a considerable branch of industry in the district of Auray, efforts were, as regards the Gulf of Morbihan and the River of Vannes, confined to allowing the oysters dredged on the hitherto fertile banks of that bay to grow in the parcs. M. Chaumel had, however, for some years past entertained the idea of making trials in reproduction, but they were without result.

The banks of the Sea of Morbihan had already been long exhausted, and trawl-fishing, which was continually practised, had prevented the few embryos which the still remaining oysters produced from becoming fixed or grow-

ing. The Administration of Marine perceived that these oyster-beds, which had been almost annihilated for the past 15 years, at least, could not be saved from total ruin except by maintaining a watch and by restricting trawl-fishing. Measures were taken with this view, and the reconstructing of the banks was set about. For this purpose 130,000 brood oysters, covered with a considerable number of young ones sticking to their shells, were brought from the banks of the River of Auray to the inland sea of Morbihan, and spread upon the old banks. This action was followed by the best results, and these attempts were crowned with complete success, especially on the bank of Bernon.

The situation is now far better; the spat is visible in various places, and we may assume that in less than 10 years, perhaps, the Gulf of Morbihan will have recovered its former wealth and fertility. I shall now inquire as to the point at which ostriculture has arrived in the maritime district of Vannes. There is progress, and unquestionable progress. In 1874 the number of parcs conceded was 140; it has since risen to 356.

The ostricultural industry at Vannes is divided into two sections, reproduction and rearing. Reproduction is the least important branch. Rearing, on the contrary, succeeds in an encouraging manner.

The immense area of projecting grounds in the Gulf of Morbihan presents favourable conditions. The sea is often disturbed, it is true; but the numerous currents running through it in every direction are, on the other hand, but an element of success when once solid parcs have been successfully established.

Three hundred thousand tiles for receiving the spawn have this year been placed on the various points in the

Vannes river ; the number of the spat adhering to each is estimated, according to the locality, at 30 to 60.

Among the special establishments which have been founded in the vicinity of Vannes, I shall mention that of MM. Duchélas & Co., on the Isle of Bailleron, which has, for dependencies, two parcs on the Isle of Lerne and the Isle of Illure, and those of MM. Chaumel, Vincent and Liazard, and de Lamazelle and Paul.

Five thousand tiles were put down as a trial by M. Duchélas & Co., in the neighbourhood of the banks of Bernon and of Bailleron.

ESTABLISHMENT OF M. POZZI.

The establishment which M. Pozzi organised at Ludré, with the aid of M. Dalido, in 1874, may be classed among the best in Brittany. It is situated near Sarzeau, in the Gulf of Morbihan. It comprises: 1st, preserve parcs of an area of 5 hectares, which are old salt-marshes transformed ; 2nd, a discharge reservoir ; 3rd, two submersible basins. It has for dependencies parcs for rearing and laying at the Isle of Kistinie and the Isle of Lerne. The basins meant for preserving oysters during the winter are fed on one side by a great pond of 40 hectares, receiving water at every tide, excepting neap-tides ; and on the other by a flood-gate, which allows passage for the rising tide, and by which the water is let out when the basins are emptied.

The soil is composed of mud and sand, but is generally firm.

The system which has been adopted by M. Pozzi as the basis of the works in connection with the rearing of the oyster is the system of continuous currents. This was suggested to M. Pozzi by the conditions in which the

natural oyster-banks are found. He has had every reason to congratulate himself on the steps he has taken. In the first year (1875) the results were marvellous ; this year they surpass all expectations. It is by means of the 40-hectare pond, and of the flood-gate at the end opposite to the pond, that perpetual circulation is kept up in the waters of the parc.

One of these preserve-basins is in part concreted, and this is the one in which the oysters are laid during the winter, to allow of their growing thicker. This arrangement, which would doubtless be of little advantage in a small establishment, has been rendered necessary by the presence at the bottom of these salt-marshes of vegetable matter in decomposition.

This parc measures 2 hectares ; it is divided into five parallel receptacles, 200 mètres long by 15 broad, each furnished with a sluice-gate in direct communication with the pond. It is with a view of keeping up the whole force of the current that M. Pozzi has established this division ; without this precaution, if the water were brought in by only one opening, the current would be dissipated in this immense area of 2 hectares, and neither the oysters on the sides nor those at the bottom would be benefited by its influence.

As may be seen, M. Pozzi follows up the principle with which he has started.

In organising submersible basins he has been guided by the same principles. These basins are cut in the rock, and surrounded by walls of cemented stone 60 to 80 centimètres thick, and 80 centimètres high, reckoning from the level ground, and are situated at the end of a sort of little isthmus very near the work buildings. They are about equal in size, and measure together 50 mètres in length by

28 or 29 in breadth, and receive water every tide. Each compartment contains 200 cases, arranged in a line with the direction of the rising tide, and separated from each other by spaces of 50 centimètres. All the cases are numbered, which prevents the spat brought from different places being mixed up confusedly, and allows of its progress being ascertained. These boxes are ballasted by large stones. The interior is divided into five or six compartments, separated by cross-pieces of wood, so that the young oysters may not be displaced by the action of the sea. Under the influence of the currents the spat attains an extraordinary development ; and I have seen young oysters picked off this year, which in the course of three months had grown from 4 centimètres to $4\frac{1}{2}$ centimètres.

Oysters of slow growth, whether the product of dredging or artificial rearing, soon attain a vigorous growth under this system. M. Pozzi this year placed 70,000 such oysters under the fall from his mill flood-gates. He contrived by the regulating of his sluices to secure a strong current, almost a cascade, and in 40 days these oysters, which had averaged 3 centimètres, attained to 6 and 7 centimètres.

The submersible basins, the parc of Kistinie, and those of the Isle of Lerne, are devoted to rearing spat in cases ; but the parts of these last parcs, where the currents are not perceptible, are reserved for laying down, an operation to which oysters already 4 or 5 centimètres in size are subjected. The growth of the oysters laid on the soil is only about 2 centimètres, but the shell becomes round, deep, and of good form. The fish, without being fat, fills it well. It is true that fattening is not the end which M. Pozzi has in view ; he has simply tried to take advantage

of the exceptional conditions that the scene of his work offered for rearing.

The operations of M. Pozzi, and what is meant in Brittany by rearing, properly so called, are as follows :—

For example, the spat that M. Pozzi bought in March, 1876, was produced at Auray towards the beginning of August in the preceding year. It was picked off in March, 1876. It was carried to the Isle of Kistinie in the month of April, and at once put in cases, and after remaining two months, part was sent to the principal establishment at Ludré to be placed in submersible basins.

The sale of such spat, which usually measures 4 or 6 centimètres, takes place in the month of September of the same year. If the buyer cannot take charge of it at once, or if the stock is not exhausted, the young oysters are transferred to preserve *parcs* for the winter. The merchants of Ile d'Oléron, Marennes, or La Tremblade, are usually the purchasers.

The extent of M. Pozzi's *parcs* allows him to raise every year six or seven millions of oysters. This number will be able to be doubled when the works of re-arrangement he has undertaken in the salt marshes at Ludré are completed.

LES SABLES D'OLONNE.

It is scarcely three or four years since ostriculture began to engage attention at Les Sables d'Olonne. Before that time there existed only *depôts* or mere holes in which merchants placed oysters which they went to Noirmoutiers to buy, whilst waiting the favourable time for sale. As a further illustration of the effects of the example set by the Ministry of Marine, the *parc*-owners have at length decided

to bring under culture the fertile submersible grounds of the basin of Les Chasses, and to convert them into parcs.

The basin of Les Chasses is 64 hectares in area ; only 25 of which are devoted to the culture of the oyster. It receives sea-water only once a week, but for a period of two or three days consecutively. The soil consists of sand mixed with mud and clay. The water which comes into the *claires* is much charged with earthy matter picked up in the basin, and necessitates the frequent cleansing of the parcs, any collecting of mud in which must be specially avoided.

These parcs, or *claires* (as they are called at Les Sables), have an average area of 250 mètres. This area varies according as the establishments are more or less sheltered from the wind. The water is kept in the parcs by embankments of earth, and only so much of it is retained as is absolutely necessary for the shelter of the young oyster from excessive heat ; cold need not be much feared at Les Sables d'Olonne. The parc-owners affirm that the less the quantity of water in a *claire*, and consequently the more an oyster is exposed to the action of heat and light, the more it grows.

Rearing and fattening are the phases of culture of oysters with which the rearers at Les Sables are familiar. Their methods are based on theories opposed to those of M. Pozzi at Ludré ; at Les Sables, in fact, there are no currents ; the water is seldom changed, and stays eight days in the basins. Last year, indeed, owing to the construction of some works in the port, the water remained in the *claires* for a whole month, without any bad effect. It is, nevertheless, astonishing to see the quick and truly surprising growth of the mollusc. In a single forenoon it

will effect a growth of a centimètre. Sometimes eight-and-forty hours will suffice for a young oyster, wounded in picking off, to remake its shell solidly enough to shelter it from its enemies.

The spat comes from Auray ; it is sent in cases lined throughout with wet sea-weed. Some parc-owners have it brought on tiles, place it in reserve, and commence picking it off later. At first it is put in oyster cases, where it remains from a fortnight to a month, in order that that which is sick may have time to recover ; afterwards it is laid at the bottom of the *claires*.

Two years in the parcs amply suffice for a young oyster to become eatable. The following are some notes which I have made respecting specimens reared by M. Monnier :—

An oyster, considered a good medium one, which was produced at Auray in 1875, picked off at Auray in January, 1876, and being from $2\frac{1}{2}$ to 3 centimètres in size when put in the parc in the month of April, measured at the beginning of September of that year 7·8 centimètres.

Another, produced in 1874, picked off and parced in April, 1875, measured exactly $9\frac{1}{2}$ centimètres in the beginning of September, 1876.

Again, a specimen produced in 1873 had acquired, by the month of September, 1876, the enormous size of 11·4 centimètres.

The operations which take place at M. Monnier's take place also at the establishment of Dr. Leroux. Dr. Leroux, in the month of March of this year, had brought from his parcs at La Trinité spat of 1875, picked off in January, 1876. When I arrived at Les Sables these young oysters were from 7 to $7\frac{1}{2}$ centimètres in size. The mode of treating oysters at Les Sables is the same as everywhere

else ; the manipulations are neither more nor less frequent ; silting up with mud is prevented ; the parcs are kept up with care ; the hair-weeds which form in them are removed ; too many oysters are not allowed to be together in one basin, and from time to time the parcs are left to rest.

In spite of the small extent of the concessions, about 10,000,000 of oysters, of which hardly one-eighth is the result of dredging, are raised yearly at Les Sables d'Olonne. It is to be presumed that production will not stop at this stage. The transformation into *claires* of the salt-marshes near the oyster-parcs will take place before long.

ILE DE RE.

At the Ile de Ré rearing and reproduction are carried on, but the ostricultural industry is not very important there. The grounds suitable for the culture of the oyster are of limited extent, and, further, it is not possible to utilise the beach west of the island, owing to the violence of the sea, which is called on that side the *mer sauvage*. Of the parcs now existing, I shall mention those of M. Dupeux-Boyer. They have been made now 15 years, and are in the outworks of an old mill ; they are situated at Le Martray, on the *mer sauvage* side, but shielded from its attacks, on one side by a dune, on the other by the Bay of Bien-d'Ars, which waters them by means of a canal. They are divided into *claires*, of which the average dimension is from 50 to 60 mètres in length by 20 to 30 in breadth, which are separated from each other by embankments of earth 25 to 30 centimètres high. These *claires* receive water every tide.

M. Dupeux-Boyer, an experienced person, has remarked, like the parc-owners of Les Sables d'Olonne, that the less water there is in the parcs the more the young oysters

grow. The bottom is sand and clay, and the mud forms at the surface a layer of 20 or 30 centimètres thick, and firm enough to prevent the oysters from sinking in it.

The *claires* of Le Martray are cleaned once or twice a year, and are used for rearing and fattening.

The oysters in them come from Arcachon, or are bred in the reproduction parcs which M. Dupeux-Boyer possesses in another part of the isle, at a place known as La Moulinatte; or else they have been gathered on the coast by fishers on foot. Although for a long time the banks in the neighbourhood of the isle have been exhausted, there exist a few stray oysters, the spawn of which attaches itself either to the rocks or to pebbles which the waves roll and cast upon the shore. The fishers by hand call them native oysters, or wandering oysters. Their shell is rough, but regular and deep.

In the parcs of reproduction, where it would be impossible, having regard to the state of the sea, to fix collecting apparatus, the spat is received on boulders simply. The picking it off at the first stage is difficult. Two or three years are necessary for the Arcachon oyster to become edible in the *claires* at Le Martray. Native oysters are less subject to mortality, and they grow more in the same space of time, the shell becomes deeper, and the fish larger.

The parcs of Le Martray have the property, like those of Marennes, of greening the oyster. Certain specimens at the Ile de Ré never take the green colour, which begins to show itself amongst the greater number of oysters towards the September equinox.

ILE D'OLERON.

At Oléron, which may be considered as a dependency of Marennes, the rearing, fattening, and reproduction of the oyster are principally carried on. In 1873 the year was bad ; the spat did not adhere to the collectors ; and the discouraged rearers abandoned their parcs. To avoid total ruin, the Administration of Marine interposed, organised model parcs, sent for 250,000 brood oysters from Arcachon, to be laid down in "La Courant;" it sought, moreover, to restore the courage of the parc-owners, who had given way to needless fears. Its advice was taken ; and the parcs, which had been damaged by mud and by mussels, were soon put into good condition. The rearing since then has succeeded so well that no one thinks now of giving up ostriculture.

In 1875 some parc-owners of Arcachon established themselves on the Island of Oléron, and the quantity of oysters they brought was so considerable that the collectors were covered with spat. This same year, the experimental parc of the Administration of Marine received abundance of spawn ; oysters and collectors were also placed in "La Courant," to form there the basis of a natural bank, and consequently a focus of reproduction. At the Castle, which is the principal centre of labour, there are 2000 parcs, 700 at Saint Trojan, 300 at Dolus ; 270 hectares are in working order. These localities are situated opposite the mouth of the Seudre. At the Castle the parcs commence at one kilomètre from high-water mark, and end at four kilomètres.

This year 300,000 tiles have been immersed ; it is a strange circumstance that these collectors have not been

submitted to the process of liming ; the plaster could not resist the wind and intense cold, which are so severe on this coast.

The spat from Brittany, which is raised in the island, generally succeeds better than that from Arcachon. The rearers say that the oysters imported from the north have a tendency to develop more quickly in the south. Without denying the effects of the influence of climate, it may be objected that this is not an absolute rule ; the oysters of Portugal, although natives of a warmer country than ours, far from running any risk in our waters, attain an enormous size in them.

The younger the oysters are which arrive at Oléron, the quicker is their development. There are some parc-owners, however, who assert that the dredged oysters grow more rapidly there than the tile oysters ; the reason they give is, that this oyster, accustomed to live in deep water, is more sensitive to the action of light and heat, which promote a more rapid growth.

Mussels are the worst plague of the parcs at Oléron. They multiply there in such number, that if the concessions are not visited each time that the tide allows of it, they soon cover the ground to a thickness of from 20 to 40 centimètres.

I will note, in passing, the efforts of M. Gaboriaud, who has successfully transformed salt-marshes into *claires* for rearing ; but his experiences are too recent, and require confirmation.

Finally, to give some idea of the unexpected extension of the ostricultural industry at the island of Oléron, I will remark that the parcs, in the month of September of this year, contained more than 70,000,000 edible oysters. As

to the young specimens which have not attained the regulation size, and the spat adhering to the collectors, it is impossible to estimate their numbers.

MARENNES.

The oysters from Marennes enjoy an universal reputation. They owe their popularity to the peculiar taste contracted in the green *claires*. There is no part of the coast where the greening of the oyster is attained so easily and so rapidly. The question of ascertaining to what causes we must attribute the change which takes place in the colour of the mollusc, from the month of September until the time of gestation, has been discussed with various results. Some have thought that it was due to the essentially argillaceous soil of Marennes, to the brackish waters of the Seudre, to oxide of iron; others assert that it is owing to the kind of vegetation which lines the *claires* at the approach of winter, and which disappears in the spring; according to these the oyster owes its colouring to the absorption of the chlorophylle with which the waters of the *claires* are saturated. A fact of common observation is that the oyster assumes its green colour when the *claire* grows green, and loses its colour when the *claire* is deprived of its vegetation.

Although Marennes is very close to Oléron, the attempts at reproduction which have been made there have been without result. The captivity of the oyster does not lessen its generative powers, as certain rearers assert. In the spring the oyster, whether in *claire* or *parc*, emits its spat; but it is to be supposed that the spat does not in the waters of Marennes, deeply charged as they are with earthy matter and perhaps too tranquil, meet with the conditions necessary to its existence. The grounds worked compre-

hend ponds, dépôts, and *claires*. The ponds are little establishments of 400 square mètres, surrounded by walls of unmortared stone, 20 centimètres high, situated on the shore, and washed by the sea at each tide. The dépôts are established on the muddy flats of the shore; they are limited by branches of tamarind, stuck in the mud, which at the same time serve as a line of demarcation. The *claires* are basins dug on the banks of the Seudre, from 30 to 35 centimètres deep.

The earth which has been taken out serves to form the slope, the summit of which is about 1 mètre from the bottom of the reservoir. They are divided into high and low *claires*; the low *claires*, nearer to the bed of the Seudre, receive the water pretty frequently; the high *claires*, further from the arm of the sea, and dug on ground comparatively higher, are only supplied during four or five days at springtide.

The greater number of *claires* are surrounded by a trench independent of the small streams (*ruissous*) of alimentation; into which are thrown the slimy deposits washed up by the sea.

The depth of the *claires*, I have said, varies from 30 to 35 centimètres; but in the autumn the water is not kept higher in them than from 24 to 30 centimètres. When the cold weather arrives, this depth is increased, for the frosts and snow are very severe, and the ice is immediately broken if it covers the reservoirs.

The low *claires* turn green first; this condition lasts from the month of September till the month of February; the high *claires* turn green in the month of November, and lose their colour towards the month of April.

The oysters reared at Marennes are produced in the parcs at Oléron, or come from Brittany and Arcachon. Arcachon as a rule sends away a great part of its products as soon as they are fit for exportation.

The young oyster is immediately placed either in the ponds or dépôts. In the month of November, after a stay of six or seven months, it is horned (*corsée*), and has attained a size of from 7 to 9 centimètres. A fortnight, three weeks, or a month, according to the position of the *claire*, is enough for the oyster to acquire the qualities requisite for consumption or "for the knife," as the parc owners at La Seudre express it.

Before leaving the parcs, however, a final process has to be undergone by the oyster to enable it to bear travelling. For this purpose it is transferred to an asphalted or sanded receptacle which receives the freshest and purest waters: the oyster remains some days in this reservoir, purges, and is then washed and sent away.

Some riparian owners (among others MM. Blanchard, Jourdes, and Le Beau) have converted some salt-marshes situated beyond the maritime domain into oyster *claires*. The success of this enterprise has caused great interest in the district of Marennes. The grounds at the disposal of the Government have all been allotted, and yet numerous applications arrive every day.

It may now be said that the success of this transformation is certain.

The ostricultural industry at Marennes has considerably increased since 1873. Parc owners on a large scale have established themselves there, and have organised very complete works as regards arrangement and means of carriage. One of the most recent, belonging to M. de Faramond de Lafayole, is worth a few words of description.

This working ground is at the mouth of the Seudre, in the Bay of Sinche. The establishment is very skilfully divided, is composed of 12 *claires*, of about 40 square mètres, six placed on each side of a dyke of 2 mètres. On this dyke M. de Faramond, who has adopted the most recent improvements, has constructed a railway with an attendant waggon, to render the transport of his fish from the boats into the *claires*, later on into the cleansing reservoirs, and from thence to the packing works at the head of the concession, rapid and cheap. He finds it convenient to keep oysters of all qualities and sizes in each *claire*, thus he has but one receptacle to empty, whatever kind may be required, and he avoids the great inconvenience of opening a certain number of sluices, and drying up several layings at times when it would be impossible to refill them. M. de Faramond has completed his packing works by a double sorter, an ingenious machine which allows two women to classify 30,000 or 40,000 oysters in one day.

To conclude with some statistical details :—

In 1873, according to the register of sea fisheries, the number of shell fish establishments was 2564; in three years it has increased to 13,526.

The *claires* occupy on each side of the Seudre an area of 20 kilomètres in length by 1 kilomètre in breadth, say 4000 hectares worked.

The number of oysters contained in the concessions is estimated at 80,000,000.

Finally, it may be said that ostriculture makes the fortune of the majority of the inhabitants of this region. Nearly all the families are proprietors or *concessionnaires* of a parc, a pond, or a *claire*, which they manage themselves. The workmen who are not tenants find employment in the

great works, and earn from two to four francs for two hours' work during spring-tides. It should be added that the Administration of Marine has endeavoured to divide the grounds under its jurisdiction in the most equitable manner possible.

LA TREMBLADE.

La Tremblade, situated on the left bank of the Seudre, is similar to Marennes, as regards the production, rearing, and greening of oysters. The soil, the methods, the culture are, with but trifling difference, identical.

I should have abstained from any special mention of the oyster industry at this station, if I had not collected some additional observations, which I will briefly summarise.

As at Marennes, there are ponds and *claires*. The ponds are at the entrance of the river, and are only uncovered at spring-tides. The spat is placed there to grow.

To a great number of rearers who do not possess ponds, the *claires* situated higher up serve at the same time for the rearing, fattening, and greening of the oyster.

La Tremblade rears easily the spat from Brittany, which, at the beginning of March or April, when it measures from 2 to 3 centimètres, is placed in the parc, where it becomes fit for eating very rapidly.

The greening takes place in a few days. A fortnight is sufficient when the *claire* is "in the humour." But the greatest care must be taken not to empty the *claire*, as it would be a long time before it became green again.

The north-west winds delay the greening, while those from the south-west favour it. The latter being warmer and damper, the oyster opens more frequently.

The *claires* are not spacious, and it has been remarked, especially in the higher *claires*, which are only submerged three or four days at spring-tide, that the smaller they are the sooner and better the oyster turns green in them.

It has also been observed, in the *parcs* where fresh water is sometimes too abundant, that the development is arrested, that the fish wastes away and quickly dies; and that if this water is entirely wanting, the oyster not only does not grow or fatten, but does not become green.

The Mur de Loup is the spot most favourable to greening. It is generally allowed that this is in consequence of the presence of fresh water. In fact, reeds grow on the edges of the *claires* which could not grow in salt water.

Thus the rearers of La Tremblade do not hesitate to attribute the greening of the oyster as much to the action of fresh water as to the nature of the soil. Some collectors have been placed in the ponds, but the spat of the Portugal oyster has alone adhered to them.

LE VERDON.

Here ostriculture is still in its infancy. The first efforts date from 1874, and were undertaken by MM. Péponnet and Tripota. They have succeeded but little, but it must not be concluded from this that the ostricultural industry cannot flourish in the roadstead of Le Verdon. Recent attempts have been made under better auspices, and if the fresh water, and the heaps of sand which the Gironde accumulates, the sole causes of non-success, can be avoided, Le Verdon will be, on the contrary, an admirably-situated station for oyster commerce. At least 80 hectares of beach are capable of being worked.

In the course of this report I have sometimes mentioned the Portugal oysters. Proposing to return to this subject on arriving at Le Verdon, I did not think it necessary to speak of it at length. The Portugal oyster has appeared for the last two or three years in our markets, it has become an article of public consumption, and, for persons of small means, takes the place of our French oyster, which is too expensive.

These oysters originate or come from an immense bank at the mouth of the Tagus. The shell is rough and ill-shaped, but it is deep, and generally well filled. This mollusc is capable of acquiring a large and rapid development in our waters ; it withstands the bad weather better, undergoes travelling more easily, acclimatises itself in places where our indigenous oyster can neither grow nor live, and accommodates itself to all waters. I am assured that its fecundity surpasses that of our oysters. Its embryos, endowed with powerful vitality, display much endurance, and can be carried a long distance by the current without being destroyed. The spat of these foreign oysters is often transported from La Gironde as far as La Rochelle, where, after having been fixed, on no matter what resisting body, it grows, fattens, and reproduces itself. It comes from a regular bed, which has formed itself not far from Verdon, on the old bank of Richard or De Goulée, nine miles from the mouth of the Gironde.

It is only six or seven years since a vessel laden with oysters from Portugal, on the point of sinking, discharged her cargo to repair her damages. A part of the oysters, supposed to be dead, were thrown into the river. These oysters have since multiplied at such a rate, and the bank has become so extended, that it is dredged without inter-

ruption, during the season in which the dredging is allowed, without exhausting it, or compromising its fertility.

In fact, this bed is a real fortune to the fishermen of the district, who reap from it an abundant and certain harvest every year.

ARCACHON.

The most important oyster station on the coast of France, Arcachon, is without a rival in the world for the number of oyster beds which are worked there, the value of the establishments founded in which ostriculture is carried on, and the stimulus to business to which this industry gives rise. The immense stretch of salt water which bears the name of the Basin of Arcachon, scooped out in the middle of a sandy plain, is in permanent communication with the Atlantic by a narrow opening. This little inland sea, into which several streams pour fresh water, a valuable auxiliary to the culture of the oyster, is subject to the same fluctuations as the ocean. It is traversed in every direction by currents, which keep up an incessant movement. These currents circulate in channels of variable length, and with a depth of sometimes 40 or 50 mètres. Between the channels are found the grounds known under the name of "*crassats*," which emerge at each tide. On these grounds, covered with *parcs* and *claires*, are established the largest ostricultural works in existence.

The oyster industry has not been altogether created at Arcachon; it has been called into existence by the presence of natural banks, to the number of 19, scattered here and there in the basin. These beds, after having passed (like the oyster-beds of the Channel, and for the same reason) through a period of decay, which gave rise for a time to a fear that they would entirely disappear, have revived, and

at the present time exhibit extraordinary fertility. The torrent of spat which escapes from them, mingling with the embryos which the oysters preserved in the parcs furnish, is so considerable, that the mass of the waters in the basin remains impregnated with it from the month of June until the month of August ; the collectors are covered with germs, and on well-placed tiles one may sometimes count 1000 or 1500. If all the progeny of each year attained to maturity, the Basin of Arcachon would soon be too small to contain so prolific a population.

Although these natural dépôts are looked upon as centres of reproduction, and as such are husbanded and watched by the Administration of Marine, yet every year fishing is authorised there for some hours, to carry off the excess of production. In this short space of time great quantities of oysters are collected and delivered for sale, or spread in the parcs. The oyster so produced, called also "native" or *gravette* oyster, is much in demand. It is distinguished by its marked form and light shell from the oyster of the channels, which is less pleasing to the eye, and of a thicker shell and less delicate flavour.

Arcachon possesses this advantage above all other ostricultural centres, namely, that the mollusc is from first to last reared there. There it is produced, grows, fattens, and passes directly into the hands of the retailer.

A description of the Arcachon Basin would require considerable time and attention to render it complete. It would be difficult for me, in this summary report, to pass in review all the industrial works which have been established there. Their number is too considerable, and their description would go beyond what you intended, M. le Ministre ; its monotony would be fatiguing, for in the greater number of concessions, belonging to the same

group, the rules and processes in use in the station vary but little. To meet your wishes, I have endeavoured to study more attentively some establishments which seemed to me to present special interest, and which give an exact idea of ostriculture as it is carried on at Arcachon.

ESTABLISHMENT OF THE OSTRICULTURAL UNION.

The works of the Ostricultural Association, at the head of which M. Venot is placed, are carried on in the Basin of Arcachon over an area of 42 hectares, comprising, on one hand, the concessions accorded under a title of management, by the Administration of Marine, to the Central Society for Aiding Shipwrecked Persons, and on the other, certain grounds situated close to the lighthouse and the parcs of Les Jacquets.

Le Cès is the place of natural reproduction ; it is an emergent ground of 11 hectares, covered with vegetation like a meadow. The soil, though tolerably firm, necessitates, however, the use of broad pattens, to prevent the treading in or breaking of the shells when walked on. The oysters which it produces are called " native " or *gravettes*.

The fishing of this oyster ground is done by squads of ten women placed in single file. Two leaders, placed at the ends of the row, direct the march. The women are separated a distance of 1 mètre from one another, and are provided with four satchels attached to their waists, in which they put the oysters as they pick them up. Followers detach their satchels when they are full, and empty them into baskets. The oysters, which lie just at the margin of the vegetation, are collected by means of a small rake.

When the fishing is over, beacons are placed on the square area where it has taken place, in order that, first, it may not be fished over a second time ; and secondly, that

later on cockle and oyster shells, the natural collectors which are employed to maintain continual fertility on the oyster-fields, may be spread over it.

The fishing on certain parts of these beds cannot go on for more than two hours or two hours and a half at each spring-tide; but as 40 or 50 persons are employed at this work, nearly 60,000 oysters a day can be collected.

When the sea has made the labourers retire, each woman goes with her burden to the ship "*Le Travailleur*," which is the centre of the works. The harvest of the day is turned out on long tables, and the women then proceed to detach and sort the oysters. They are so used to this work, and their eye is so practised, that they rarely employ the ring in order to classify the oysters according to size. This operation over, the oysters are sent off to the different parcs—to Lahillon to grow, and to Crastorbe to fatten and prepare for travelling.

The parcs at Lahillon are old oyster-grounds, from which the vegetation has been removed to convert them into *claires* for growing. On marine plants the growth is less rapid than on the bare soil; a square, however, of natural oyster-ground has been left, and such is the quality of the grounds at Lahillon that the *gravette*, or native, grows more quickly there than on the oyster-layings at Le Cès. The average size of this oyster at 15 months is from 2 to 4 centimètres.

The *claires* measure 45 mètres in length by 6 in breadth, and 30 centimètres in depth. They are separated by little banks from 1 to 2 mètres broad, formed of lumps of the clay found on the Island of Oiseaux, and supported by tiles placed on end.

One hundred thousand oysters can be parced in these *claires*. The specimens fed there are the little oysters gathered on the *crassats*, which require to grow before fattening, and the spat on tiles, which is only introduced after having remained in the packing cases till the month of April, when the very dangerous tide of the March equinox is over.

The native oysters of which the growth has been arrested are placed in the reserve *claires*. In their new abode they return, after a little time, to a normal growth, and gain in six months from 2 to 4 centimètres.

As it is essential not to lose an inch of the precious working ground, the banks west of the *crassat* of Lahillon are utilised as free parcs ; but to facilitate the access to the higher *claires*, at every 20 mètres a space has been left where boats can moor.

ILE DES OISEAUX (PARCS OF CRASTORBE).

L'Ile des Oiseaux is the largest *crassat* in the basin, and the parc owners regard it as the most favourable ground for the cultivation of the oyster. The Ostricultural Society possesses 11 hectares of *claires* there. The soil of these *claires* has been made before being used ; it was originally composed of a bottom of mud several mètres thick, and of so thin a consistency that it could scarcely be walked on, even with large pattens.

The consolidation of the soil has been affected thus : A layer of shell-gravel, which is common in the Arcachon basin, was first laid down. On this layer, the thickness of which varies according to the greater or lesser fluidity of the mud, was spread another layer of pebbles, as large as nuts, from the quarries of Gazinet, near Bordeaux. These parcs, being in the neighbourhood of strong currents, have

had to be surrounded by palisades. They are served by a floodgate, which retains the water, for they emerge at every tide; but to avoid the injury which the rising tide might cause, the sluice is opened, when the sea has half filled the *claire*, by passing above its banks.

This part of the Ostricultural Society's concession is set apart for fattening, and for preparation for travelling.

The oysters are not transported here till they are 6 centimètres, or above that, in size; here they recover and become plump, but they only gain 2 centimètres in a year.

The oysters of Crastorbe are produced on the soil and on the tile. A certain number have been laid down at La Tremblade, but usually their first growth is effected at Lahillon. I will add that the bottoms of the *parcs* at Crastorbe have remained in a state of natural oyster-grounds.

MM. Venot & Co. raise, at the same time, the native and tile oyster. Reproduction on collectors is obtained, especially at Lahillon, and in the *parcs* of Les Jacquets. Tiles alone are employed, and are placed from the month of May to the month of June, according to the average temperature of the spring, which also regulates the emission of the spawn. They are taken up towards the month of November. The separating is done on board "*Le Travailleur*," and usually before the winter. The spat is immediately put in boxes, where it passes the cold season, and recovers from the wounds which separating may have caused. When transferred in the spring into the *parcs* at Lahillon, it has become sufficiently strong to brave its enemies.

The Ostricultural Union has this year put down 110,000 tiles, and its *parcs* contain nearly 30,000,000 young oysters. Sixty persons are continually occupied in this vast labour, and at times, when the work is heavy, this

number is increased to 80 or 90. Experiments have been made by M. Venot on the American oysters. Of four barrels of spat sent from America, two arrived in good condition, and the surviving specimens quickly recovered the fatigue of their long voyage in the parcs of Crastorbe. Their development was rapid, and one cannot do better than compare them with the Portugal oyster, which they resemble in many respects. The American oyster has been little approved of in this country, and its rearing has been abandoned.

As is the case with nearly all the principal oyster cultivators, and especially with M. de Montaugé, whose works are truly magnificent, the oysters which come from the parcs of Venot & Co. are not immediately sent away. They are transported first to the basins annexed to the dispatching department, where they are allowed to cleanse ; they are then washed and classified anew. The sorting is done by machines, which render this work easy ; a single woman can sort from 20,000 to 30,000 in one day.

Among the principal parc owners of La Gironde, who, side by side with their purely commercial industry, make experiments with the view of perfecting the methods of oyster-culture, I shall cite MM. de Montaugé Frères, who have organised, on the road to La Teste, an experimental laboratory in their large establishment at Saint Joseph.

This laboratory, to which will be very shortly annexed a studio for research and observation, which will be provided with microscopes, consists of a basin of an area of 1500 mètres square and 1 mètre deep, divided into two compartments, one of which is devoted to the preparation of oysters to be sent away, the other to experiments. The first

compartment is lined with cement ; the bed of the second has been re-made, and a layer of clay beaten and dammed up, surmounted by another layer of muddy sand and shells, has been substituted for the original materials.

These works have been executed to prevent any introduction of water from the iron springs which rise in the concession of MM. de Montaugé, the metallic element of which is hurtful to the oyster. The basin is fed by means of a large floodgate opened at the rise of the tide, and closed when it recedes. This floodgate is placed at the head of a channel, the water from which is blended with fresh water at the mouth of a small stream. At first great care was taken lest this fresh water should mingle with the sea water during the refilling of the basin.

Amongst other experiments made by the MM. de Montaugé, they inquired into the aptitude which the captive oyster might have for producing spat capable of development. For three years the adult oysters parced in the reservoir of observation emitted no embryos, and even grew thin. The experimenters attributed this impoverishment to the too great saltiness of the water, which was so great that it deposited salt crystals on the marine plants contained in the basin. The want of success was evident ; the experiments were abandoned, the oysters removed, and the piece of water converted into a fish pond. From this moment care was no longer taken to prevent the mingling of the waters of the stream of which I have spoken with the sea water in the supply canal, and some time after, in raking the soil, a few oysters were found which had been overlooked. It was noticed that they had developed and grown stronger, and a more extraordinary and an unexpected fact was that traces of spat were found in the neighbourhood

of the floodgate, and of the springs which rise here and there on the banks.

This wholly fortuitous discovery put MM. de Montaugé on the track of the truth. Some hundreds of oysters were again placed in the basin, and some collecting apparatus which was laid down became covered with spat.

It has been denied that these embryos came from the specimens experimented on, but from what source could they emanate? No parc of reproduction is to be found in the neighbourhood; the tide, which might have served to convey them, must have traversed many kilomètres of *crassats* before entering the establishment; and this long passage across the emergent grounds, under the summer sun, so heats the sea water that the spat lose all their vitality in it. But, it has been also urged, how can these very waters, too warm to furnish the embryos with the normal conditions of existence, be fit to preserve the spawn of the captive oyster? We have an explanation of this apparently contradictory fact, if we remember that the fresh water of the stream, which we have already mentioned, was allowed to enter the canal of the establishment, and by its freshness to lower the temperature of the salt water.

Another experiment of MM. de Montaugé, with the aim of determining what influence the soil could have on the development of the mollusc, was to deposit in one part of their basin some earth taken from the parcs at Oléron. Oysters of the same size and age were placed on this earth, and others were put by their side on ordinary soil. The result was that the growth of the specimens was almost equal, but the former were better nourished and more horned.

All oyster cultivators know that extreme cold and ice are prejudicial to oysters. The proprietors of the works at

St. Joseph possess a basin containing 200,000 oysters. The basin having been frozen over, MM. de Montaugé immediately had the water renewed, and the reservoir covered with straw and hay. This plan succeeded, and only 100 specimens suffered from the frost.

I will not leave the establishment of St. Joseph without noting an interesting fact. In the parcs which are most exposed to rough weather, and during the stormy season, the oysters are turned, and laid on their flat sides.

This ingenious arrangement renders the animal less accessible to the action of the cold, and gives the shell a firmer position, thus preventing it from being too easily lifted by the surf from the waves, and from being thrown to a distance by the violence of the sea.

MM. Grangeneuve & Co. also possess an establishment which deserves special mention. M. Grangeneuve has solved the difficult problem of raising the oyster in oyster-boxes from its birth, until it is fit for eating, whilst diminishing the great expense which the adoption of this method involves. His establishment is very fine, and no pains have been spared to render it one of the most complete of Arcachon. M. Grenier's station is also of the greatest interest. M. Grenier is one of the oldest parc-owners of the basin, and he has more than once rendered services to the industry in which he has so long been engaged.

MM. Brown & Goubie have introduced into their parcs cemented *claires*, which greatly diminish the expenses of maintenance necessitated by the ordinary *claires*. These *claires* are expensive to construct, but are very solid, and especially useful on grounds flooded by the sea.

M. Vidal, on the contrary, in the construction of his *claires*, uses neither tiles, boards, nor cement. He has

managed to form with mud and potter's earth, beaten in and dammed up, embankments sufficiently firm to resist the waves. The facts are that the *parcs* of which M. Vidal is the holder in the Ile des Oiseaux are very sheltered, and that the adaptation of his evidently economical plan would not be possible in the greater number of the concessions in the Arcachon basin.

M. Fillon has connected with his production *parcs* a building for various business purposes, very cleverly arranged, in which he has made numerous and interesting experiments. M. Fillon is, besides, one of the *parc* owners who carries on the oyster industry on a large scale.

I have still to mention MM. Surette and Gaston de Faramond, who are ceaselessly engaged in furthering the progress of ostriculture. Before summing up with some simple statistics, I must remark that the products of Arcachon are not all such as are usually seen in our markets. Those tiny oysters which *parc* owners, impatient to sell, offer to dispose of as soon as they measure the regulation size of 5 centimètres, are only trash, or immature specimens.

There are in the Arcachon basin 3317 *parcs*, held by 3934 persons, and occupying an area of 3836 hectares.

The exportation amounted, during the season of 1873-74, to 42,542,650 oysters of 5 centimètres; during that of 1874-75, to 112,705,233 oysters of the same size; during that of 1875-76, to 196,885,450. The value of the oysters sold in 1875-76 was 3,941,309 francs.

I have now reached the end of my task. I have doubtless omitted to mention many establishments worthy of interest, and some localities where, as at Tréguier and Paimpol, the ostricultural industry prospers, without, however, presenting to the observer any new facts for study, or

suggestions worth ventilation. I will not dwell on this further. But I am unwilling to close without speaking of the fruitful idea which the Department of Marine, which is always aiding progress, has this year realised. It relates to the conversion of salt-marshes into rearing *claires*. If the efforts, Monsieur le Ministre, which your Administration has so happily undertaken at Croisic have an ultimately favourable issue—and the success of the first season makes me sanguine—a new and brilliant future is in store for ostriculture.

The conversion of salt-marshes into oyster establishments will finally insure large outlets for that overflowing excess of production which every year is a cause of embarrassment to the oyster cultivators of Arcachon and Brittany.

This will be one benefit, in addition to the many which our people in the West will owe to the Marine, which has already done so much for them; and France, generally, will be the gainer by a movement which will, through a new process of industry, restore to the deserted salt-marshes their former wealth and prosperity.

Permit me, M. le Ministre, before closing this report, to present my grateful thanks to the Commissaires and Agents of the Marine with whom I have been in communication. I owe them this public acknowledgment, having always found in them the most perfect readiness to facilitate my labours, combined with that courtesy for which the Marine has always been distinguished.

Accept, Monsieur le Ministre, &c.

BOUCHON-BRANDELY,

Secretary of the College of France.

CHAPTER XXV.

OYSTER CULTURE IN FRANCE.

RETURN to an Order of the Honourable the House of Commons, dated 1st August, 1882; for Copy "of Translation of a REPORT made to the Minister of Marine in France, by M. Brocchi, relative to OYSTER CULTURE on the SHORES of the CHANNEL and of the OCEAN, and published in the 'Journal Officiel de la Republique Française,' of the 8th November, 1881, (in continuation of Parliamentary Paper, No. 220, of Session 1877)."

T. H. FARRER.

Board of Trade, 1st August, 1882.

REPORT.

By a decision, dated the 30th June last, the Minister of Agriculture and Commerce, in accordance with a request made some time past by the oyster cultivators of the Breton district, and with the desire formally expressed by the senatorial commission upon re-stocking the waters, has instituted a course of oyster-culture and marine pisciculture in the laboratory founded by Coste at Concareneau (Finistère.)

This course, entrusted to M. Brocchi, teacher of zoology at the National Agricultural Institution, was inaugurated on the 5th of September, and has been continued during one month.

Independently of oral instruction, M. Brocchi is charged with the duty of making researches in connection with the important questions to be dealt with in the course. He has just addressed to the Minister his first report upon the observations made by him, and upon the actual condition of oyster-culture which is subjoined.

Paris, 30th Oct., 1881.

Monsieur le Ministre,

The preparation for the course of oyster-culture, which you have been so good as to entrust to me, has led me to visit the principal centres of oyster-culture in France.

I feel it my duty to render you an account of what I have had an opportunity of observing during my trip, and to lay before you the actual state of oyster-culture in our country.

This industry, which is so new and so essentially French, has made rapid strides.

It is not for me now to give the history of oyster-culture; but suffice to say, its origin is of recent date. In fact, it was not till after the publications and the experiments of M. Coste (1856-1858) that the attention of the inhabitants of our coasts was attracted to the possibility of rearing oysters artificially.

These experiments, to which the State devoted considerable sums, produced great effect.

M. Coste, with an enthusiasm, perhaps somewhat exaggerated, but productive of definite and happy results, announced that a new source of wealth was opened up to France.

The experiments, conducted simultaneously in the Ocean and the Mediterranean, proved for the most part failures.

On the other hand, and this has been too much overlooked, the experiments in the basin of Arcachon were crowned with success.

Since then the stimulus has been given, and the industry of oyster-culture has not failed to make rapid progress.

Oyster-culture comprises two very distinct branches; one being production, the other, rearing and fattening.

Production aims at the collection of the embryo oysters, and in this way saves a vast number which but for the intervention of man would be lost.

It is well known that at the moment of its birth the young oyster is provided with locomotive powers, enabling it to swim in the midst of the sea.

After drifting for some time, the young oyster fixes itself on some extraneous body, loses for ever its locomotive organs, and becomes the mollusc so well known.

But these embryo oysters cannot fix themselves indifferently upon any bodies coming within range.

These bodies must be sufficiently smooth and clean. It happens, therefore, that in the natural course of things, a great quantity of these minute beings, the spat, not finding any objects to which to become attached, falls to the bottom of the sea and perishes. Indeed, that portion which has become attached under favourable circumstances is for a long period exposed to many dangers.

With the view of obviating these inconveniences, the oyster-culturists lay down in the vicinity of natural beds different bodies, designated by the name of collectors, which are intended to collect and preserve the spat.

When the spat has become sufficiently developed it is detached, taken off, and given over to the rearer.

Rearing consists in placing the spat in the best conditions possible, so that it may grow rapidly, and, so far as can be, be sheltered from the attacks of its natural enemies. Then comes the fattening, that is, the investing the oyster with those physical conditions which render it a luxury for the table.

I must now examine in succession the most important centres of production and rearing.

The two districts in France in which production is attended to on a large scale are, 1. Arcachon; 2. Le Morbihan.

BASIN OF ARCACHON.

In 1863 the industry of oyster-culture did not exist in this basin. At this epoch, in fact, one of our most distinguished pisciculturists, M. Chabot Karlen, published a report upon this part of France. From this interesting work it will be seen that the production of oysters was absolutely neglected in the basin. It is right to add that at that time M. Chabot foresaw the possibility of rearing oysters "in the wide water on the Crassats."

Oysters, however, existed in a natural state in this basin. Here, nevertheless, as everywhere, ignorance and want of foresight had produced bad results. The natural beds were silted up with mud, and the oysters were rapidly disappearing.

Under these circumstances it was that M. Coste resolved upon the establishment of some model parcs in this district. Three spots were selected on the surface of the basin, and here the success was complete.

Thus one of the new parcs, that of Lahillon, four hectares in extent, furnished in 1866 more than 5,000,000 of oysters.

Now when the operations were commenced in 1863 on this spot, there was nothing but mud.

After cleaning the ground 400,000 oysters were laid down in 1865, and as I have just observed, the return the following year exceeded 5,000,000.

Such examples were well calculated to make impression upon the coast population; in consequence, applications for concessions began at once to multiply, and, as I shall presently show, continued to increase.

Some years later the State perceiving that its example had failed, conceded its model parcs to the central society of shipwrecked mariners; but a certain extent of oyster beds was reserved, and serves to supply with spat the surrounding concessions.

The beds so reserved occupy an area of 200 hectares; no fishing is permitted except at intervals of about three years, nor unless a commission representing the fishermen and the cultivators has expressed itself favourable to the fishing.

The Marine Administration takes great interest in this reserve. Every year 240 *mètres cubes* of small shells are thrown on the surface of these parcs, and form in this way natural collectors. At the time of the last fishing (1879) this reserve had furnished 25,000,000 of oysters, representing a value of about 250,000 francs. In the month of April, 1881, when I had the opportunity of visiting these beds, they were covered with fine oysters, and appeared to me to be in excellent condition.

The collectors used at Arcachon consist almost exclusively of tiles previously limed and disposed in hives.

About 10,000,000 of tiles are laid down every year; the most favourable moment for the operation appears to be from the 12th to the 15th June. The hives remain in position until the month of October; some cultivators, however, allow the collectors to remain all the winter in the basin. This practice is attended with danger, as the spat may be destroyed by the frosts.

Anyhow the young oysters are placed either in the *claires* or in the boxes. The *claires* of Arcachon have been too often described to make it necessary for me to do so now.

I shall, however, call to recollection that their depth varies according as they may be intended to receive the spat when detached, or the tiles to which the young oysters are still adhering.

As a fact, a certain number of cultivators allow for some time the spat to develop itself on the tiles themselves.

The use of boxes is general at Arcachon. Still as these engines are somewhat expensive, some cultivators have for economical reasons given up their use. On the other hand, some establishments possess a considerable number. In April last, for instance, 4,000 of these might be seen in one parc alone.

The present occasion does not, Monsieur le Ministre, seem fitting for entering into the details of working arrangements. I desire solely to bring under your notice the proof of the importance of oyster-culture in this part of France.

The following figures, for which I am indebted to the extreme courtesy of M. Lhopital, Commissary of Marine, are in this point of view specially interesting.

RESUME OF OYSTER OPERATIONS IN THE BASIN OF
ARCACHON.

YEAR.	Number of Parcs.		Number of Oysters Exported.	Value.		Average Price per thousand.
	Conceded.	Existing.				
				<i>fr.</i>	<i>c.</i>	<i>f.</i>
1865....	297	297	10,584,550	338,705	0	40
1866....	4	301	7,052,000	282,070	0	40
1867....	39	340	4,921,210	191,175	0	16
1868....	94	434	8,599,675	319,186	35	37
1869....	30	464	10,145,687	419,784	0	45
1870....	21	485	6,541,140	352,666	12	58
1871....	276	761	4,897,500	268,332	50	55
1872....	371	1,132	10,796,740	537,515	0	50
1873....	106	1,238	25,711,750	1,159,397	0	41
1874....	1,175	2,413	42,542,650	1,745,950	0	45
1875....	626	3,039	112,715,233	2,817,630	0	25
1876....	306	3,345	196,885,450	3,941,309	0	20
1877....	301	3,646	202,392,225	4,456,288	0	22
1878....	285	3,931	176,500,225	4,426,500	63	25
1879....	184	4,115	160,197,275	3,944,241	88	25
1880....	144	4,259	195,477,357	4,254,465	64	25

On examination of these figures it will be seen :

1. That the number of the parcs which in 1865 was only 297, amounted in 1880 to 4,259.
2. That during that period the number of oysters exported rose from 10,584,550 to 195,477,357, representing a value of 4,254,465 francs.
3. That from 1870 to 1880 the number of oysters exported has exceeded one milliard, and it must be remarked that the oysters cannot be sold until they have obtained a minimum diameter of five centimètres.

It will be seen that the average price per thousand has greatly diminished of late years. This is due to the great quantity of Portuguese oysters introduced now into the basin of Arcachon.

And here, Monsieur le Ministre, I must not pass over in silence the sensation which has been caused in the ostricultural world in consequence of the introduction into our waters of Portuguese mollusca.

Some distinguished oyster-culturists have, in fact, advanced the opinion that the Portuguese oyster might cross with the *ostrea edulis*, and by altering its purity diminish the value of our indigenous oyster. They even announced that they had observed unequivocal traces of this hybridation upon oysters coming from Arcachon.

Among the cultivators at Arcachon this announcement caused an emotion all the more lively, as one of the inspectors of fisheries in England had induced his countrymen to purchase no more oysters coming from Arcachon.

Allow me to submit to you the result of my observations on this subject.

The mollusc known under the name of the Portuguese oyster does not belong to the same genus as our indigenous oyster. While the latter is included in the mollusca belonging to the genus *ostrea*, the former takes its place among those constituting the genus *gryphæa*, the species *gryphæa angulata*, Lamarck.

In other words the Portuguese oyster is not an oyster in a zoological point of view.

To afford some base for the allegation of hybridation between the two mollusca it would be necessary, in the first place, to prove that zoologists have been mistaken in creating these two genera, and that Lamarck was in error in separating the *gryphæa* from the oysters properly so called.

In fact, in the present state of science, it is impossible to admit the crossing of two species belonging to different genera. All that we know on the contrary is opposed to the possibility of such a hybridation.

Until then, I repeat, it has been proved that the genus *gryphæa* should be omitted from our classifications, the cross between the mollusc of the Tagus and our edible oyster cannot be admitted.

Even allowing the identity of genus of the two molluscs, the characters mentioned by the partizans of hybridation do not appear to me to possess much scientific value.

These characters consist merely in the colour of the shell, and no one can be ignorant of the extent to which the colours may vary of animals belonging unquestionably to the same species. Finally, to be silent on no point, I will add that, from the experiments of MM. de Montaugé and Bouchon-Brandely (experiments which do not seem to me to have been conducted with sufficient scientific precision), it would appear that the spermatozoa of the Portuguese oyster cannot fecundate the ova of the *ostrea edulis*.

I, for my part, can affirm that, during my stay at Arcachon I never observed any fact which would make me believe in a change in the oyster produced in that district.

To sum up, I do not believe in a cross between the two molluscs; but I must add that the introduction into our waters of the Portuguese oyster does not strike me as unattended with danger.

It is known, in fact, that when two species are compelled to live side by side in a limited space there springs

up between them what a celebrated naturalist has called the struggle for existence.

This struggle must, sooner or later, end in the discomfiture and disappearance of the weaker species.

Under these conditions, if the *gryphæa* and the ordinary oyster are brought together, the latter must necessarily succumb.

The Portuguese mollusc is unquestionably more robust, more enduring, and, I should say, more prolific. The facility with which it propagates its species is really very remarkable.

It is known how the Portuguese oyster took possession of a portion of our coasts : A few hundreds of them having been accidentally brought to the embouchure of the Gironde, soon formed considerable beds.

Even this year I have been able to see collectors placed on the shores of the Isle of Oléron, covered almost exclusively with Portuguese spat.

I think, therefore, M. le Ministre, that in the generality of cases, the culture of the *gryphæa* if carried on in the vicinity of parcs of ordinary oysters, may lead to serious evils.

And yet, I must repeat, I saw nothing at Arcachon leading me to think that the Portuguese oyster would supplant the ordinary oyster.

Here is in addition the very disinterested testimony of M. Lhopital, Commissary of Marine, to whom I had imparted my fears on seeing the daily increase in the introduction of the Portuguese oyster into the basin of Arcachon. He wrote to me recently as follows :—

“ Previous to the question of hybridation, that of the entire occupation of the collectors by the Portuguese oysters had produced commotion among the maritime population of Arcachon. Some *parqueurs* had even

demanded that the introduction of these oysters into our waters should be absolutely prohibited, and in the beginning of 1878 the minister directed an inquiry into the matter.

“It was ascertained that the danger apprehended was not serious. It is more than twenty years since enormous quantities of Portuguese oysters were introduced into the basin of Arcachon, which came either directly from the mouth of the Tagus, or from the Bay of Corogne, or from England, or the embouchure of the Gironde. Well, with perhaps the exception of one or two years it has been remarked that the reproduction of Portuguese oysters has been but trifling. The collectors detached this year may be said practically to have had none on them; and I have had much trouble in finding a few specimens on the reserved beds.”

M. Lhopital attributes this failure in the reproduction of the Portuguese oyster in the basin of Arcachon to the purity of the waters and the absence of mud.

I am very much disposed to accept the explanation given by the Commissary of Marine. It is, in fact, to be remarked, that, wherever the Portuguese oyster is seen to propagate rapidly, there the presence of mud will be found in a state of suspension in the water.

Still, M. le Ministre, it seems to me that the oyster cultivators of Arcachon should take some precautions, and watch attentively what is going on in their parcs. A change in the currents would quite suffice to load the waters with mud, and cover the collectors with the spat of the Portuguese oysters.

I am not of opinion, however, that the State should interfere in this question otherwise than by giving advice.

Such then at the present time is the condition of the oyster industry in the basin of Arcachon, a condition which is certainly remarkable and worthy of fixed attention.

MORBIHAN.

Another important centre for the production of oysters exists on our Breton coasts. It is known under the name of the Oyster Basin of Auray.

The cultivation of oysters in this region is of recent date. It is now fifteen or sixteen years since the first collectors were placed in the rivers of Morbihan. The centre of the operations is to be found in the rivers or creeks which run into or open out in the Bay of Quiberon. The oyster breeding establishments in going from west to east, occupy successively the Creek of Po, the Trinity River, the Creek of St. Philibert, and the Auray River.

Natural beds of oysters exist in most of these rivers. The most important are those in the Auray River, which are about 22 kilomètres in length, and those of the Trinity and St. Philibert rivers, which extend for about 15 kilomètres.

Unfortunately these beds are in bad condition. This year they have been carefully explored by dredging, and the results obtained have been far from satisfactory.

Subjoined is a table showing the results of oyster fishing in the district of Auray from 1876 to 1881.

AURAY RIVER AND DEPENDENCIES.

Year.	Number of Boats.	Number of Men.	Number of Women.	Duration of Dredging.	Quantity of Oysters Dredged.	Average Price per Thousand.	Total Produce of Sale.
				H. M.		<i>fr. c.</i>	<i>fr.</i>
1876	594	1782	..	20 30	19,974,000	21 65	432,341
1877	623	1664	332	13 0	13,343,000	19 75	263,652
1878	694	1852	448	15 45	27,145,000	15 75	427,841
1879	782	2183	447	8 45	11,173,000	16 70	186,670
1880	809	2379	491	9 30	8,283,000	20 40	175,263
1881	882	2516	445	15 0	11,061,000	13 70	157,645

TRINITY RIVER.

1876	133	429	..	10 30	2,042,000	17 0	31,722
1877	115	273	..	11 40	2,558,000	22 20	50,232
1878	154	400	108	7 40	2,206,000	22 50	49,591
1879	135	418	101	6 20	1,058,000	22 0	23,330
1880	88	198	79	4 15	257,000	34 0	8,737
1881	83	167	112	4 50	601,000	24 0	14,670

If these figures are referred to one scale, *i.e.*, to the number of oysters obtained by one dredger in an hour, the following are the results :—

AURAY RIVER.

1877	One dredger in one hour produces	411	oysters.	
1878	„ „ „ „	747	„	
1879	„ „ „ „	485	„	
1880	„ „ „ „	315	„	
1881	„ „ „ „	262	„	

TRINITY RIVER.

1876	One dredger in one hour produces	453	oysters.	
1877	„ „ „ „	453	„	
1878	„ „ „ „	712	„	
1879	„ „ „ „	566	„	
1880	„ „ „ „	322	„	
1881	„ „ „ „	444	„	

From the above it will be clearly seen that the beds are becoming less productive ; it is true that in the Trinity River the average revived in 1881, but when it is considered how low the totals have been (in 1881 the total number of oysters dredged was only 601,000) the averages are not very accurate. One portion of a bed, in fact, after remaining undredged for several years, may yield a great quantity of oysters, and thus raise the average considerably.

In spite of these unfavourable conditions, the production by the rivers of Auray is not unimportant, as the following figures will show :—

Years.	Marketable Oysters Exported.	Spat.
1876-77	7,260,000	46,056,000
1877-78	8,094,000	46,004,000
1878-79	7,684,000	40,526,000
1879-80	10,599,000	37,618,000
1880-81	33,325,000	155,418,000

Some observations are now necessary. In the first place, it is to be remarked that these figures are necessarily below the actual fact. In obtaining them regard must be had to the alleged practice of certain oyster cultivators of concealing the actual amounts through fear of their patents being raised. The number of oysters exported either from Brittany or from other centres of oyster culture is considerably higher than that stated by those interested.

It must also be remarked that the spat is furnished not merely by the natural oyster beds, but also by important reserves which are owned by numerous oyster cultivators. This explains how, in spite of the precarious state of the natural beds, the yield of young oysters continues to be abundant.

The figures which I have the honour to submit to you will further show the sensible increase in oyster production in the basin of Auray. In 1876-77, the number of oysters exported was only 7,260,000. In 1880-81 it had reached 33,325,000.

The oyster cultivators of this district have to contend against a natural obstacle, the mud which abounds in the rivers and creeks of Morbihan. Thanks to an ingenious disposition of collecting tiles, this obstacle has been sur-

mounted. The collectors, if disposed in hives, would become rapidly covered with mud; this method has consequently been discarded in favour of that which is called the *bouquet* or *champignon*.

The tiles are pierced with one hole at each extremity, and are joined some 12 or 14 together by means of wire.

They are then attached firmly to the head of a stake, 1 m. to 1 m. 50 in length, which can be easily fixed in the ground.

This system, the first idea of which is due to M. Leroux, has the double advantage of preventing the accumulation of mud on the collectors, and of rendering the fixing of these engines easier and more rapid.

The time which appears to be the most favourable for laying down the tiles is in Brittany from the 1st to the 20th of July. This date is one month later than that in which, in the basin of Arcachon, this operation is conducted. The difference is easily explained by the difference in temperature at these two points on our sea-coast.

The use of boxes is not so frequent in Brittany as at Arcachon. For this there are several reasons, the most important of which is the following:—While the oyster cultivators at Arcachon are unable to export their oysters until they have attained the size of five centimètres, the Bretons are at liberty to sell, generally, the oyster while in the condition of spat, and are not bound to occupy themselves with the rearing.

The question of price is an important one, especially as oyster culture is still in its infancy in this district.

A certain number of oyster cultivators in Brittany substitute, to some extent, for the use of boxes, the use of what is termed *l'huitre à tessons*.

This expression may be thus explained: the young oysters are left for a certain time on the tiles, and then, instead of detaching them, the collector itself is cut into fragments.

Each oyster adheres to one of these fragments. This system, which was invented by one of our most distinguished oyster-cultivators, Dr. Greppy, possessed the advantage of placing the oyster in a better position for resisting the attacks of its natural enemies; the crab, for instance.

Other cultivators allow the oyster to remain fixed to the collector for two years. They place the tiles, when covered with spat, in the emerging basin or merely in the *claires*. The loss attending the operation of detachment is considerable; but some oysters are checked in their growth owing to their pressing too closely one against the other.

These are the facts, M. le Ministre, I desired to bring to your notice. I have no occasion now to enter into further details, but will proceed to consider the centres for rearing and fattening.

The most important centres for fattening will be found at Marennes and La Tremblade.

Marennes has been noted for many years for the production of green oysters; but for some time past this locality has supplied commerce with large quantities of oysters which have been imported from all parts of France, and laid down for the purpose of rearing and fattening.

The following figures, for which I am indebted to the kindness of M. Senné-Desjardins, show the importance of this trade at Marennes.

YEAR 1880-81.

The number of oysters imported into Marennes was 190,000,000, of which 130,000,000 were introduced into *viviers* and *dépôts*, and 60,000,000 were introduced into *claires*.

Of the 130,000,000, 40,000,000 were Portuguese and 90,000,000 French oysters.

YEAR 1880-81.

Oysters exported from Marennes, 151,000,000. Of this number, 54,000,000 Portuguese and 47,000,000 French went from the *viviers* and *dépôts*; 50,000,000 were produced from *claires*.

Marennes has sent out this year 151,000,000 oysters, representing a value of 5,900,000 francs.

I should point out, Sir, that, for the reasons already stated, these figures should be raised rather than lowered.

Marennes, then, it will be seen, in addition to the oysters reared in the *claires*, carries on an important trade in oysters. Of the 190,000,000 imported in 1880-81, 60,000,000 only went into the *claires*.

It is also impossible not to perceive how the trade in Portuguese oysters has developed. Of the 151,000,000 of oysters sold this year, 54,000,000 were Portuguese.

I must now pause for an instant to dwell on the care bestowed by the cultivators of this district on their *claires*. Not that I desire now to bring forward facts already well known, but because I conceive that the administration of the *claires* of Marennes might be imitated with advantage in other centres of oyster cultivation.

The *claires* are placed on both banks of the Seudre; they are not, as at Arcachon, submerged at each tide, but

only at spring-tide. Some are even a long way from the banks of the river. They are so worked that some are in a state of preparation whilst others are in use.

The preparation of the ground generally goes on in March. It includes two operations: *gralage* and *la mise en humeur*.

Gralage has for its object the purification of the soil by evaporation; it lasts from six weeks to two months. The *claires* are cut; that is, the water is no longer kept in them, and they are not visited by the sea except at high tides. They dry in the sun.

When the *claire* is *gralée*, or, in other words, covered with a well-drained bed, 15 days are spent in bringing it into condition.

A small quantity of water is allowed to enter, and the retention is resumed.

The dry crust dissolves in the water, produces a kind of effervescence, and the final result is a uniform deposit on the *claire* of a creamy precipitate, which is called *humeur*. The oysters may now be laid down, and they begin to turn green at the end of a fortnight.

This operation must be conducted every year. The oysters are laid down at the bottom of the *claire*, and placed at a proper distance from each other by hand. About 5000 are placed in an area of 33 ares.

Down to the present time the industry of Marennes has been confined to rearing and fattening. It is to be hoped that before long production will be introduced into the locality.

The Commissary of Marine of this quarter is indeed actually engaged on this question.

Having resided for a long time at Auray, M. Senné-Desjardins is conversant with every question pertaining to

oyster cultivation. His intelligence, and the devotion he displays in all his duties, allow of the hope that this new enterprise will be a success.

On many other points of our sea-shore the rearing of oysters engages attention.

I do not consider it desirable to pass in review all the localities where the industry is exercised, but I will ask your permission, M. le Ministre, to speak a few words respecting one of these centres which, I think, possesses special interest.

I wish to speak of the parcs established some time since at Courseulles. They are situated in the vicinity of the Seulle, a small river which runs into the sea at this point of our Norman coast.

The canals which communicate with the sea and the oyster basins are so disposed that when the sea rises it cannot, during neap tide, get beyond the sluice gates; consequently, during that period, the sea water is not renewed. During spring-tide the salt water can enter the canals, but only after having mixed with the fresh water of the Seulle.

Pure sea water never enters the parcs.

It has been long ago remarked that the oysters placed in the basins of Courseulles fatten rapidly and acquire a particularly delicate taste.

I have thought it important to bring forward these facts, because, from all I have learnt and from all I have seen, it appears to me that the blending of fresh and salt water is a condition which, if not indispensable, is at all events one of the most advantageous for the fattening of the oyster. In the same way, the currents influence, in an unquestionably beneficial way, the growth of the oyster.

French oysters transported to the mouth of the Thames, where the water is nearly fresh, soon acquire the qualities which recommend them to the gourmet. Many of the oysters sold as Ostend oysters have no other origin.

It has further been remarked that oysters taken in the bay of Chesapeake are much fatter than those dredged on other parts of the American coast. It is very probable that this favourable feature is due to the numerous streams of fresh water which run into the bay.

I believe, then, that the fattening of the oyster ought to be recommended on all the parts of our coast where natural conditions render possible a blending of fresh with salt water.

At Lorient, several establishments where this desideratum has been realised are on the high road to prosperity. These examples might easily be multiplied.

For some time past the rearing and fattening of oysters has engaged attention in the basin of Auray.

The cultivators here have to contend with a difficulty arising out of the want of consistency in the soil. But their industry has surmounted this unfavourable condition by macadamising the mud. For this purpose they place on the surface of the soil sand and stones, which eventually form a sufficient resting bed.

I believe that the cultivators of Brittany will eventually raise oysters by these means. But I fear that fattening in this district is not followed by good results. In fact, except in a few favoured spots, the want of fresh water will be a serious obstacle to perfect success.

I need not, I think, M. le Ministre, dwell more upon this portion of my report. But I desire to draw your

attention to this fact, that while oyster cultivation is relatively a success on our ocean-bound coasts, it is, so to say, not represented upon our Mediterranean shores.

All the attempts made formerly by M. Coste have been without result. I consider it useless to recur to these unfortunate experiences, but there is some degree of interest in the inquiry whether oyster cultivation ought to be definitely abandoned in this part of France.

At present several species of oysters live in the Mediterranean. These are as follows:—

1. *Ostrea Edulis* and its varieties. This oyster appears to experience difficulty in existing in the Mediterranean, except in that portion of the sea which washes our coasts. It never forms beds. Some solitary specimens may be found on the muddy bottom, at a depth of from 30 to 60 mètres, outside the embouchure of the Rhone.

2. *Ostrea Cyrnusii*.—This oyster bears a great resemblance to the *Edulis*. It is distinguishable more particularly by the greater length of the hinges. It is found in the brackish water on the east side of Corsica.

3. *Ostrea Cochlear*.—I only cite this species as a matter of form. It is a very small and rare oyster, living at a great depth (100 to 140 mètres). In a comestible point of view it has no interest.

4. *Ostrea Stantina*.—This is a small species, tolerably abundant at Toulon, but more rare on the rest of our coast. It seems to prefer impure waters.

Of these species two only offer any interest in a cultivator's point of view. These are the *Ostrea Edulis* and the *Ostrea Cyrnusii*.

All the experiments which have been made down to the present time have been with regard to the *Ostrea Edulis*.

M. Coste used for his operations oysters produced by the coast of Brittany. As already remarked, this species does not propagate itself readily on our Mediterranean coasts. Many zoologists attribute this fact to the water of this sea being too salt.

However this may be, I think that new efforts should be made, and that this time the oysters from the coasts of Corsica should be employed, *Ostrea Cyrnusi*.

I am inclined to believe that this species would afford good results, if introduced into the marine ponds so numerous along our southern coasts, to which I have already had the honour to draw your attention.

Such, Monsieur le Ministre, are the chief points to which I was desirous of inviting your attention.

To sum up, the state of oyster culture in France is sufficiently satisfactory.

This new industry has not only succeeded in sending a great quantity of these mollusca to the markets of our country, but it likewise exports a considerable number. Thus last year French cultivators sent to London 28 millions of oysters. Belgium receives several millions every year.

Nevertheless, I am convinced that oyster cultivation might be more fully developed, if it were protected from certain dangers by which it is menaced, some of which are really of a grave character.

Permit me, M. le Ministre, to lay before you these dangers, as well as the means which, in my opinion, should be employed to combat them.

I have already had occasion to refer to the rapid deterioration of the natural beds. This, without question,

is the most grave danger in any way of oyster cultivation. It is therefore of moment to trace the causes to which this state of deterioration may be ascribed.

Two main facts may be brought forward.

In the first place, it is necessary to refer to the thefts committed on the beds, which are of incessant occurrence.

These thefts are committed openly. The thieves not only attack the reserved beds, but may be seen to take up their position on *parcs* owned by individuals, breaking the *claires*, and taking away their contents. The employés of the Marine, though well-intentioned, and of undoubted loyalty, are not in a position to meet the depredations of these undaunted robbers.

As a fact, the means at the disposal of the maritime authority are not in the generality of instances adequate for the pursuit and capture of the poachers. This class of pirates being furnished with swift craft, having an admirable knowledge of the grounds upon which they are operating, and always taking advantage of rough weather, cannot, as a rule, be caught.

The coastguard will never be able to act efficaciously until they have steam-sloops at their command. This expedient, which has already been recommended by M. Robin, a member of the Senate, seems to me to be the only way of ensuring an effectual surveillance.

But this is not all. When, under fortunate circumstances, the thief has been captured, the punishment awaiting him is really ridiculous.

One may see a man who, in a few hours, has stolen oysters worth two or three hundred francs, condemned to pay a fine of five francs !

Another very important cause of the deterioration of the natural beds is the over-dredging.

It is a known fact, that before reaching a marketable size the oyster requires a period of time which may be computed at two or three years.

Now on certain parts of our coasts, and especially in the rivers of Auray, dredging is conducted every year.

True it is that fishermen are recommended to throw back under-sized oysters, but everyone must see that this is an ineffectual measure !

It ought then to be made imperative that dredging should not be conducted on the same bed oftener than every second or third year. Such is the practice at Arcachon, and I have had occasion to point out that the results are excellent.

A further cause of the non-development of oyster cultivation, in Brittany at all events, is the rent, to my mind too high, which is exacted from the *concessionnaires* of the shore.

While at Arcachon the rent ranges from 30 to 45 francs the hectare, according to the position of the parcs, cultivators in Brittany pay no less than 100 francs for an equal area.

Now these shores are fit for no other purpose ; they are simply mud-banks, without any value whatever. The sum of 100 francs the hectare is more of the nature of regular rent than a concession.

Here, then, is a really high tax pressing heavily upon a new industry, which on every account deserves protection and encouragement.

Besides the interest which this industry presents in itself, it is not to be forgotten that the oyster cultivation occupies each year a great number of persons, women and children, who, but for it, would be without employment.

To sum up, I think, M. le Ministre, it would be desirable to see the Government take the following steps :—

1. Place at the disposal of the coastguard a certain number of steam-sloops, which are the only craft fit for pursuing with success the poachers on our natural beds.

2. Regulate the dredging of these beds, so that no bed should be dredged except once in three years.

3. Recommend to the competent authorities increased severity in the repression of robberies committed at the expense of the cultivators.

4. Lower the rents exacted from the *concessionnaires* of parcs in the Brittany district, in such a way that the amount of this tax shall not exceed that which is demanded from cultivators in the basin of Arcachon.

As regards the recommendations to be made to the cultivators, they will naturally find their place in the course which you have thought it desirable to institute.

The persons who are engaged in this industry have it, moreover, in their power to do much for themselves. With this consideration, I would suggest the formation of companies for oyster cultivation.

The cultivators of Auray have entertained the idea of such co-operation. The re-union which took the title of company, for the cultivation of oysters in the basin of Auray, has already afforded excellent results.

This company publishes monthly a report of proceedings, and it has likewise founded a museum of oyster culture, possessing great interest for all persons engaged on questions relating to the production of oysters.

This example ought to be followed by all centres of oyster cultivation. Such, M. le Ministre, are the facts to which I was desirous of inviting your serious attention.

In conclusion, permit me to say how greatly I have been aided in my researches by the agents of the *administration maritime*.

M. Broquet, lieutenant in command of the *Moustique*, the following Commissioners of Marine, viz., MM. Senné-Desjardins, Lhopital, Gestain and Castelin, have obtained for me valuable information.

If in this report I have succeeded in bringing together any facts of interest, I owe my success to the courtesy I have received from the gentlemen whose names I have just mentioned.

Accept, M. le Ministre, &c.,

DR. P. BROCCHI.



CHAPTER XXVI.

OYSTER CULTURE IN FRANCE.

RETURN to an Order of the Honourable the House of Commons, dated 21st May, 1883; for Copy “of Translation of a REPORT made to the Minister of Marine and Colonies in France, by M. Bouchon-Brandely, Secretary of the College of France, relative to the GENERATION and ARTIFICIAL FECUNDATION of OYSTERS, and published in the ‘Journal Officiel de la Republique Française,’ of the 15th December, 1882 (in continuation of Parliamentary Paper, No. 333, of Session 1882.)”

T. H. FARRER.

Board of Trade, 21st May, 1883.

THE PORTUGUESE OYSTER—HYBRIDATION OF OYSTERS—EXPERIMENTS IN ARTIFICIAL FECUNDATION—METHODS OF ARTIFICIAL FECUNDATION—APPLICATION OF ARTIFICIAL FECUNDATION—REARING.

Paris, 5th December, 1882.

Monsieur le Ministre,

The Marine Administration has, since the creation of the ostricultural industry, never ceased to encourage by different measures, such as concessions, missions, &c., every attempt having for its object the development and

perfecting of that industry. It is to this, unquestionably, that ostriculture owes its present prosperity, and the constant progress it has achieved, a progress which has been so brilliantly represented at the Exhibition of Bordeaux.

Faithful to precedent, you have been so good, M. le Ministre, as to authorise us, under your auspices, and with your encouragement, to make the researches of which we are now about to render an account.

These researches were commenced in 1880, at the College of France, in the Laboratory of Comparative Embryogeny, which is under the direction of M. Balbiani (the eminent successor of M. Coste), who has aided us with his advice, and have been continued in the same laboratory, and on different points of our sea coast, and have had reference to :—

1. The sex of the French oyster (*ostrea edulis*) and of the Portuguese oyster (*ostrea angulata*).
2. The fecundation, incubation, and development of the eggs and embryos of the two sorts of oysters.
3. The possibility of a cross between them.
4. The artificial fecundation of the Portuguese oyster.

The limits of this report will not permit us to give full development to the questions which we have considered, or even to approach them all. We shall shortly have the honour to present you with a complete work on the subject. At present we shall specially occupy ourselves with our experiences in the artificial fecundation of the Portuguese oyster, as this oyster appears to us to offer the most immediate interest.

The Portuguese Oyster.

The mollusc known under the name of the Portuguese oyster did not exist on our coasts 30 years ago. The Delessert Museum (Lamark Collection) contained the only specimen we had. Its introduction and acclimatisation are due to an entirely accidental cause.

The natural history of this oyster was little known, and there were but very vague ideas with regard to it. It was supposed to be similar to the ordinary oyster, from which, however, it differs : 1, in form ; 2, in flavour ; 3, in habits ; 4, in sexuality.

It is superfluous to describe its external appearance, which has no resemblance to that of the *ostrea edulis*.

As regards the taste and flavour, even the least cultivated palate can perceive the difference. As regards its habits, we know that it delights in brackish and muddy waters, and multiplies in them in preference to every other locality. It is found, in fact, in the Gironde, on the coasts of Oléron, and at the mouth of the Charente, where the water weighs by the areometer from $1\frac{1}{2}$ to 3 degrees.

It also breeds in the basin of Arcachon, but to no extent, and only at those points where the influence of fresh water is felt. In this locality a rather curious phenomenon may be observed, viz., that the Tagus oyster becomes unfertile after a certain time, so that it would entirely disappear from the basin but for the continual introduction of fresh specimens, which perpetuate the species.

As regards the sexuality, there is a greater and more radical difference between the two species of testacea. The *ostrea edulis* is hermaphrodite ; the *ostrea angulata* is unisex, or of two genders. We have opened more than 10,000, in every phase of the reproductive period, and

never found one in which the sex was doubtful. They were all either exclusively male or exclusively female. The difference is also equally great in the mode of reproduction. The eggs of the ordinary oyster are fecundated in the interior of the valves, apparently in the generative orifices ; those of the Portuguese are so in the water. The former cannot develop themselves out of the incubating cavity ; the latter can do so in the open current. The larvæ of the *edulis* must, to live, form themselves, and attain the period of their roving existence out of the albuminous liquid secreted by the parent ; those of the *angulata*, which are more vigorous, independent, and sooner able to move, carry in themselves or obtain, in spring tides only, the elements of nutrition and constitution, which are necessary for their transformation into spat.

HYBRIDATION OF OYSTERS.

There are, then, between the Tagus oyster and that of our coasts very great differences, as much in point of conchology, or the exterior, as in the internal soft arrangements, and especially in point of embryology. The characters peculiar to each are so strongly marked that had they been well known the question of hybridation, which has so thoroughly alarmed our maritime population, would not have been raised. It will be remembered that, according to a theory advanced by some *parqueurs*, the two rival oysters are capable of being crossed.

The Portuguese oyster, on the one hand, was said to debase the race of our own fine oysters, and, on the other, in consequence of its vitality and fecundity, to substitute itself for them, to take possession of our beds, and destroy our parcs for reproduction. This anticipation has, happily, not been realised ; and our oysters, whether the *gravette* of

Arcachon, or the fine-shelled pearly oyster of some rivers in Brittany, the green oyster of Marennes, or the deep and nourishing oyster of Sables d'Olonne, have lost none of their purity or primitive qualities. It seems needless to reproduce the reasons, which are of a serious character, by means of which this theory has been combated.

Here we will make one simple remark. It will soon be 30 years since the Portuguese oyster was introduced into the waters of Arcachon. If it had exercised on the native oyster of the basin the influence attributed to it, it is quite clear that in this ostricultural station no single oyster would be found free from the effects of the cross.

But can a single district be cited in which this oyster has produced a ruinous effect, or has diminished fertility? Has it done so to the oysters of Arcachon? The *crassats* which have not been transformed into *parcs*, or the *chenaux* of the basin, are they less productive than formerly? Have the remarkably rich banks of Brittany (and the Portuguese oyster has been placed in *parcs* in the Auray and Trinity rivers) suffered in the least degree? Does the dredge bring to light many Portuguese oysters or hybrids? No; we repeat that these fears have not been justified, and this is so for the reason already given, viz., that the two descriptions of oysters live and flourish under different physical conditions.

Moreover, the experience which is described below demonstrates scientifically the hollowness of the doctrine of hybridation.

The most certain mode of ascertaining whether a cross could take place consisted in bringing together the generative elements of each species taking part, or supposed to take part, in it.

Such is the course adopted when it is sought to discover whether individuals belonging to kindred species, or to varieties of the same species, are capable of contributing to the formation of a new individual. Frequently, when the subjects are kindred species, or varieties of the same species, although the cross in fecundation may not result in the production of any living animal, or any likely to live, the elements are brought together, and fecundation takes place several times. Sometimes even the *ovum* is formed, and attains a greater or less degree of development, &c., but when the same elements brought together remain unaltered, an absolute sterility may be concluded.

This is precisely what we have had to observe in the attempts at direct hybridation which we have made during two years, last year and this year.

At different times, and in different media, we have brought into contact the *ova* of Portuguese oysters and the fecundating liquor of the ordinary oyster, and *vice versâ*, and in no case in the conditions in which our experiments have been conducted have the elements shown any natural approach to each other; in no case has there been any trace of fecundation or development.

EXPERIMENTS IN ARTIFICIAL FECUNDATION.

When, two years ago, we had arrived at certainty in the separation of the sexes in the *ostrea angulata*, we perceived at once the possibility of the fecundation of this mollusc by artificial methods. We were, moreover, encouraged by the experiments of M. Brooks, of the University of Baltimore, which he had made on the Virginia oysters, which are equally unisex, experiments which had allowed him to follow the development of the embryo as far as to the formation of the shell.

We commenced by some experiments in the Laboratory of Embryogeny in the College of France, which, without being conclusive, at least indicated to us the course to follow, and the manner in which the experiments should be conducted. In the course of the same year these essays were repeated with great success at Arcachon. Last year we obtained, for the first time, moving larvæ. We were greatly surprised at what we observed; we were quite unprepared, after an incubation of twelve hours only, for so speedy a manifestation of external life; our surprise was the greater, inasmuch as at this phase of evolution these larvæ show themselves in an aspect in which it is impossible to foresee their definitive form.

On the other hand, we did not discover in what has been described and stated on the subject of the incubation and transformation of the *ova* of the *ostrea edulis* any mention of this phenomenon of precocious locomotion, which, we believe, had never before been observed.*

The advanced season of the year in which we were, and the difficulties there were in procuring at Arcachon Portuguese oysters in the state fit for the accomplishment of the generating functions, did not permit us to recommence our experiments with favourable result, or to define in what respects they were obscure.

* At the time when great attention was bestowed in France to the artificial fecundation of the *ova* of fish, a discovery just made by the fishermen of the Vosges, Géhin and Rémy, it was held out that it would be possible to treat the *ova* of the ordinary oyster, the only oyster then known to us, in the same manner. But the hermaphroditism of this mollusc having been demonstrated, it became necessary to abandon this hope. At all events artificial fecundation, if in a scientific point of view it had been possible, would never have led to industrial consequences, for this reason, that the *ova* and embryos of the *ostrea edulis* cannot be developed except in the cavity for incubation.

At the commencement of last season, considering the slow progress our researches had made, we had no hope of being able to solve in a single campaign the problem of artificial fecundation, as applied to ostricultural industry.

In resuming our labours, we felt bound to give serious attention to the choice of a locality suitable for our experiments.

The position of Verdon, situated on the left bank of the Gironde, and some kilomètres from the mouth of that river, appeared to us to combine the desired conditions. We were sure to find there oysters fitted for reproduction as well as suitable waters. As a matter of fact, the first fecundation, which we tried by way of experiment, gave us, after fourteen hours, moving *larvæ*, and this, too, although the spawning season did not commence till a month later.

M. Tripota, a veteran, and at the same time a most competent ostriculturist, was so good, at the request of M. Commissary Jouan, and with a good grace and disinterested feeling, for which we are glad to be able to thank him, as to place at our disposal two beautiful *claires* not intended for submersion, which received fresh water several days during spring tide. These were soon adapted to our requirements by means of some slight internal arrangements. Separated from each other by a substantial belt of earth, these two sheets of water, each of a superficial area of about 100 mètres, and of an average depth of 80 centimètres to the mètre, were supplied by one common trench. A pipe, each end of which was furnished with a strong sponge for the purpose of retaining the bodies held in suspension by the water, formed a communication between them. In this manner no doubt could subsist as to the origin of the spat collected.

At the outlet, an apparatus consisting of a wall of fine sand, faced with boards to stem the ripple of the sea, allowed the water to run out, but prevented the embryos from escaping with it. The lower *claire* alone was used in the experiments. The upper one, in which when possible the water was stored, served as a filtering bed, and thus the conduit of alimentation admitted into the *claire* for experiment only such water as had already been clarified.

Having taken these first steps, the product of the artificial fecundation obtained by different methods was admitted into the reservoir.

This took place in the second week of June.

As we expected, it was possible to find spat on the collectors at the end of that month, or the commencement of July. M. Tripota, who had soon mastered the manipulations, and in our absence supplied our place, continued to introduce into the *claire* ova which had been fecundated, and moving larvæ.

The term assigned for the duration of the trial having expired, the collectors were examined, but showed, apparently, no trace of reproduction. It had been a deception. But the reflection that the spawning season had not yet commenced in the Gironde allowed us to hope for ultimate operations of a happier nature. The *claire* was emptied, modifications were made in the supply of water, and a fresh effort was made in daily introducing the combined elements of generation.

On the 24th July an inspection was made of the tiles; on this occasion they were all found with spat on them. It was then perceived that the former experiments had not been so fruitless as we had supposed. In fact, to each of the tiles immersed quite at the first were attached from twenty to thirty young oysters, measuring about a centi-

mètre in diameter ; these evidently dated from the end of June or the commencement of July, but their diminutive size had prevented their being seen at the inspection which was then held. On the 24th July we had some specimens of about a month old ; this fact was the more remarkable, inasmuch as at the very same time the collectors placed in the Gironde, the very centre of reproduction, had not yet received any spat.*

The problem which we had proposed to ourselves had, in a scientific and practical point of view, received a solution conformable to our expectations ; it was shown to be possible to obtain spat from artificial fecundation, and to keep it in closed waters. Nor could we at all doubt as to the identity of the spat which our tiles had received, or suppose that it had come from without, considering that, as has already been said, there was no spat as yet in the Gironde, and also that the tiles placed in the upper *claire*, used for feeding the experimental basin, were entirely devoid of spat.

If in forcing nature we arrived at such a result, namely, the production of young before the normal period for the emission of spawn, *à fortiori*, a more beneficial result might be expected from aiding and assisting her. While conducting our researches in the establishment of M. Tripota, we judged it desirable to vary our modes of inquiry, and even to investigate the industrial side of the operation.

Along the course of the channel of Conseiller, and fed by it, are certain old salt marshes, for the most part abandoned or diverted from their original uses, but a few of which have been transformed into reservoirs for fish. The marsh in which we established ourselves is about two kilo-

* Note to the Academy of Sciences, 11th July, 1882.

mètres from the river, and the district of Verdon, and receives the water when the tides are at their highest.

It is composed of several compartments varying in depth, and communicating by means of broad incisions in the platform separating them. The entire surface would exceed a hectare. At new and full moon the flood-gate for alimentation is opened, so that the fish brought down by the current may enter, and the water be renewed. This process is repeated several times during spring tide. Owing to the situation of these marshes on the open shores of the Gironde, the water is never stagnant even at the times of quadrature ; the sea swell, and the winds from the ocean and from the river, keep the water perpetually aërated by agitating its surface.

The marsh selected by us was of a depth of from five to six feet in the centre, and from two to three feet at the sides. Some stakes placed at intervals supported pieces of tile suspended in the water by wires.

From the commencement of July to the end of August M. Gassiau, Instituteur at Verdon, who throughout our campaign seconded us with an intelligence, zeal, and devotedness worthy of all praise, was careful to turn in several times a week the result of the fecundation, which he managed himself with rare ability and remarkable certainty. Three hundred oysters only were devoted to these experiments.

On the 8th August he visited the collectors, and observed on all, without exception, some hundreds of little oysters of from one to two *millimètres*. Each of these successive fecundations was visible by the presence of objects whose size indicated their age. Having had the curiosity to know in what number they were to be found, we counted

more than *eight hundred* upon one piece of tile, the size of which was barely one-fiftieth part of an entire tile. This time the success was complete.

Until the end of the month of August, when the oysters had nearly all spat, the spat continued to fall with equal abundance upon all the collectors it met with indiscriminately, such as *débris* of tiles, bits of wood and planks, &c.

As no doubt could exist, the pessimists asked themselves whether our brood would grow and develop itself to the size of that collected naturally on the *crassats* of the Gironde. Our answer to this objection was by sending some tiles to the parcs of Arcachon, where they remained a month and a half.

These tiles, or fragments of tiles, appeared at the end of September at the Bordeaux Exhibition, side by side with those sent by MM. Tripota and Gassiau.

It has thus been seen that the spat born in the close *claire* at the beginning of July measured from two to three centimètres, while that collected in the salt marshes at the end of July and the month of August had attained the dimension of a centimètre, and a centimètre and a half. Finally, in the first days of October, we had the honour to present the Minister of Marine with a tile upon which could easily be counted two thousand little oysters, from one to two centimètres.

It remained for us to make a last demonstration. It was necessary to prove that the spat collected did not come from the district of the Gironde, but was the result of the artificial fecundations effected by our labours. This proof was evidently superfluous after what had occurred in the confined and unaërated water of the *claire*, where we were first established. We knew, moreover, that the

farmer of our experimental marsh had, two or three years previously, in vain attempted to collect spat. But, in undertaking this counter experience, we were pursuing a double object, that of the disappearance, so to say, of the last doubts, if any yet survived, as to the value and advantages of artificial fecundations, and that of creating partizans.

The proof was conclusive.

At the entrance of a fish-pond next to ours, and nearly of the same size, similarly arranged, and receiving the same water from the same gully, had been placed some tiles upon which the spat coming from the river could not fail to become attached. At that moment we were in the full career of reproduction ; the collectors of the Gironde were being charged with spat, and ours were so as fast as they were submerged. We expected, accordingly, to find some young oysters upon the collectors placed for the purpose of the trial. It was not the case ; these collectors remained completely free from every trace of reproduction.

METHODS OF ARTIFICIAL FECUNDATION.

Imperfect and incomplete as our present methods of artificial fecundation may be, we believe it will be useful to make them known at the present time. There is, moreover, no better method than publicity for stimulating progress and the improvements of which it is susceptible. After different attempts and numerous experiments, the following is the method which we have found most successful.

It is easy, with a little practice, to determine with the naked eye the sex of a Portuguese oyster. A small quantity of the matter contained in the genital gland is taken,

and this is diluted on a slip of glass by employing a quantity of water equal to several times the volume of the portion of matter.

In the case of a female the liquid becomes granulous, and upon examining it carefully, ova may be distinguished which have been detached by the water. In the case of a male the mixture of the seminal fluid and the water is effected with greater difficulty, and the liquid remains opaque and milky.

With the aid of a magnifying glass this investigation is made extremely easy.

The choice of the reproductive specimens is not, there is reason to believe, immaterial to the success of the operation. Care must be taken not to use oysters procured from raised positions, which are frequently left high and dry. *

We have never with them obtained good results. The fecundation may take place, the separation proceeds sometimes to a considerable degree, but all at once the development stops, the eggs change, and their membrane bursts.

To avoid all disappointment of this kind, it is desirable to proceed with subjects taken from lively and deep waters. It is also always important to be satisfied that the elements to be employed have arrived at their maturity.

* Our opinion as respects the sterility of certain specimens rests upon two important observations made in the Isle of Oléron. We have tried in vain to fertilise oysters taken from the raised portions of the oyster concessions of the island, while at the same moment, with the same conditions, in the same medium, with the same water, and under the same external influences, the experiments have resulted in the formation of moving larvæ, if the specimens employed were taken on the same part of the coast, but from the deeper portions. Nevertheless, we claim for ourselves reservation upon this point.

Independently of verification by means of a microscope, an instrument which few ostriculturists possess, knowledge on this point may be obtained as follows. 1. By an examination of the gland. If this gland is transparent at any point, this means that the evacuation of the generative elements has commenced, and, consequently, these elements are mature. (This remark applies to the gland of the male as well as to that of the female). 2. By the separation of the ova from the ovarium. If the ova are easily detached by the simple rubbing of a fine pencil, they may be considered as fit for fertilisation. It may, however, happen that some barren ova may detach themselves from the gland easily, but this is not the case except when they have received some injury.

When the seminal liquor mixes easily with the water, it may be assumed that it will act efficaciously.*

After making these arrangements, and when a recipient has been prepared half or three parts full of sea-water, incisions are made in the ovary gland, and by means of pincers, with fine and flexible points, the ova are detached and placed in the receptacle as fast as they are detached. At this period they must be washed, with the view of facilitating impregnation.

* Here the microscope is of the greatest utility, especially if it is desired to ascertain the quality of the fertilising element. In order that this element, which can be examined only with a powerful glass, may fulfil the duty expected from it, it is necessary that the animalcules which compose it should be distinct, independent, and living. In cold weather they are often observed to be motionless, but this is often when they are merely numbed; it is enough to expose them to warm air, or to place them in water of 22 or 25 degrees of temperature, in order to awaken vibration and activity. Disintegration is obtained in certain circumstances by the same procedure. Cases of barrenness are generally very rare.

This operation purges the ova from the impurities which may have become attached, and aids the separation of such ova as may be still glued together. For this purpose the contents of the receptacle are shaken either with the hand or with a pencil, and then the liquid is left quiet. Half an hour or an hour after, the ova which are unchanged are precipitated at the bottom of the mud which remains suspended in the water; all foreign matter, torn membranes, damaged ova, &c., must then be eliminated. This operation of decanting may be repeated with advantage.

The seminal fluid is obtained by the same means as the ova, but necessitates no preliminary preparation. It is poured on the mud in which the ova are lying, and the fecundation takes place at once.*

Henceforth the successive phenomena of development can only be observed with a microscope. After coming in contact with the elements the ovum, which at first was in the shape of a pear, by degrees becomes round; the germinative organ diminishes, to disappear soon altogether, the polar globule shows itself at a point on the circumference, the ovum divides itself into two, three, four segments, and then into so many that at last it assumes the appearance of a raspberry. To describe clearly these different transformations and metamorphoses, drawings will be necessary. After incubation for seven or eight hours, according to the temperature,† the embryo becomes agitated, moves

* From observations made in the laboratory of M. Balbiani by M. Henneguy, the ovum of the *angulata* appears to be provided with a *micropyle* placed at the point of severance; that is, at the end of the *pedicule*.

† At Verdon we obtained moving embryos seven hours after fecundation, the water being of a temperature of 22 degrees.

in the water, and a larva is seen capable of moving about. The motive power of this larva is evidenced by the accelerated rotatory motions, and by the precipitate starts which enable it to traverse the field of observation. Sometimes it gyrates as if on a pivot, sometimes it remains quiet and motionless; but an attentive examination will show that the vibrating *cilia* with which it is furnished never cease to execute the movements which are peculiar to them. Arrived at this period of its existence, and considering the minuteness of its girth,‡ further observation becomes difficult. We have, however, been able to discern the rudiment of a shell about the seventh day.

Fecundation succeeds without the necessity for conforming rigorously to the indications we have detailed. The determination of sexes, for example, is not even necessary, for in operating on a certain number of subjects there is a certainty that among them will be found males and females. It is the same in decanting; but we must admit that it is a useful precaution which offers real advantages, and facilitates the examination of the phenomenon of development.

We may add that the generative elements keep during several hours, and without being brought into contact, all

‡ The larva has a volume nearly equal to that of the ovum. Now the ovum of the *angulata*, if supposed to be perfectly spherical, and taking the minor axis of this sphere as the diameter, measures:—Diameter, 52 thousandths of a millimètre; volume, 73,584 thousandths of cubical millimètres.

With the view of comparison, subjoined are the measures obtained from the following species:—Oyster of Dackar, unisexual; diameter of ovum, 43 thousandths of a millimètre. Oyster of Toulon (*Ost. plicatula*), hermaphrodite; diameter of ovum, 95 thousandths of a millimètre. Ordinary oyster (*Ost. edulis*), hermaphrodite; diameter of ovum, 122 thousandths of a millimètre.

their vital properties. Our collaborateurs have, like ourselves, obtained the best fecundations with elements which have not been brought together for one or two hours after their separation from the glands.

In bringing this account to a close we will mention some relative observations:—1. On the influence exercised by the water at different densities, in the operations with which we are engaged, 2. On artificial hatching. The waters employed at Verdon weighed, according to the areometer, from two and a quarter to three degrees.

At Cette we used, with success, the waters of the Mediterranean, the density of which in this locality attains nearly four degrees.

In the present state of our researches it is difficult to draw any conclusion from the facts which we narrate as they present themselves, and especially from the two which precede. It appears no less certain that, although oysters cannot prepare for reproduction in salt water, the same salt water may prove not unfavourable to fecundation and to development.

As regards attempts at artificial hatching, we have done no more than apply the methods which are employed in the similar case of the eggs of birds. The eggs of oysters laid in a water kept at a uniform temperature of 20 degrees, are hatched after $10\frac{1}{2}$ hours of incubation.

It might, perhaps, be profitable to make researches in this direction, for if methods of artificial hatching could enter the domain of industry, the incubation of eggs would be practicable at all times, except in stormy seasons, which destroy the *ova* and even the *larvæ*. With our present experience hatching as well as fecundation do not succeed well except in warm and fine seasons.

APPLICATION OF ARTIFICIAL FECUNDATION.

Is it necessary to insist upon the economy of artificial fecundation, or to bring forward in evidence the advantages offered by it, and to point out the new horizons it opens up to ostricultural industry?

The Portuguese oyster is endowed with a marvellous fecundity.* If all the *ova* produced annually by the innumerable subjects to which the Gironde gives protection were hatched, and if, on the other hand, the waters of the river were sufficiently rich to feed them, all portions of the sea would soon be swarmed. The causes of destruction are, however, numerous and powerful, for the collection of spat is always contingent, either owing to the fact of inclement temperature, or to the fact that the waves impelled by the winds disperse and destroy those legions of *larvæ* which are seen to be hatched.

Now the methods which we recommend will provide an escape from some of these disturbing causes, and will assure to those who put them in practice a certain harvest in places sheltered from fluctuation of temperature, and where persistent bad weather would not be able to check the regularity of the abundant return.

* A cubic centimètre of ovary contains :—

	<i>Ova.</i>
Method of separation - - - - -	2,500,000
———— cups - - - - -	5,200,000
Total -	<u>7,700,000</u>

(Average, 3,850,000.)

The volume of the ovary of an oyster of average size varies from 6 to 8 cubic centimètres; hence an oyster of three or four years old can lay every year about 20 millions of eggs.

With the ordinary oyster these figures are reduced to twelve or fifteen hundred thousand eggs.

But this is particularly to be noticed, that there would be not merely one harvest each year, but two, and perhaps three harvests. In fact, as the season for spat lasts at least for three months, this period of time is sufficient, as we have conclusively proved at Verdon, to allow of *collectors* being placed three times in the same *claire*, and being withdrawn as often covered with spat.

There is no want of spots fitted for the reception of establishments for hatching.

Such spots would be found at the mouth of the majority of our rivers. Only two conditions are necessary; brackish water weighing according to the areometer from $2\frac{1}{4}$ to 3 degrees, and facility for the introduction of fresh water into the reservoirs. We may, perhaps, better display the advantage and economy of our system in borrowing an example from river pisciculture.

It is known with what success the *ova* of fish are dealt with under the methods of artificial fecundation, the laws of which M. Coste has determined and fixed. The scourge of the depopulating of waters having, so to speak, spared no European State, the question of pisciculture is, to some extent, the order of the day everywhere, and it ranks with those questions of economy which demand a prompt solution. Hence the special laboratories of pisciculture which have been created in Switzerland, Germany, England, Russia, Norway, &c. Artificial fecundation is their grand point, and forms the base of their operations. This is because it gives results far superior to those which would be obtained if nature were left to act freely. Thus out of 1,000 *ova* treated artificially, and kept in incubating vessels, 980 are hatched perfectly; while in natural waters the losses are reckoned at 90 out of the 100.

We admit that the *ova* of *salmonidæ*, from their size, are much more readily submitted to artificial fertilization than those of the *angulata*, but however large a figure may be given to the losses attendant upon the application of the same methods to the *ova* of bisexual oysters, their artificial fecundation would none the less prove a productive operation. Let us see what occurs in a state of nature. The female oyster emits *ova* in considerable numbers; but how few of them meet in the immense extent of water that which will instil into them the principle of life? To estimate this is difficult; but if we assume the proportions indicated above, we find that out of 20 millions of *ova* which may be emitted by the parent, 2 millions only arrive at the state of moving *larvæ*.

Having reached this phase of transformation, how many will become attached to the collectors? One must not expect that the tenth of what survives will escape the multiplied dangers with which it is constantly surrounded. In closed waters it is otherwise. In the first place, impregnation is guaranteed to all *ova* capable of being fertilised by placing them in forced contact with the fecundating element. Thus is suppressed the first cause of loss, which is doubtless the most important. We escape a second cause, which is also serious, in keeping the embryos in closed reservoirs, where, sheltered from all the various dangers to which they would be exposed in the open, they pass tranquilly the period of their erratic existence till the arrival of the time when they feel the necessity of attaching themselves to the collectors which they find within their reach.

Figures will be more eloquent than the best of arguments. 100 *ova* fertilised have produced 80 moving *larvæ*. This is the average, according to our experience, which

was obtained at Verdon. Considered in its industrial aspect, the system of capturing the spat in waters shut off would be infinitely more economical than the present system.

The only collectors which are adapted for large spaces are tiles, which by their weight offer resistance to the currents. Boards, slates and other light bodies have been in turn abandoned. But tiles become costly when they are disposed in hives on the *crassats*. The mere placing them occasions considerable expense, and cannot be effected except at certain tides and in favourable weather.

In closed waters collectors could be placed and withdrawn at any phase of the moon, and in any condition of the sea without any risk of breaking them. There is no necessity for fixing them to the soil. More than that, there would be no occasion for the exclusive use of the tile, for the tile, though an excellent collector, has its disadvantages, especially on the banks of the Gironde, where oyster rearing is no longer held in estimation. As the weight would render its carriage expensive, it is kept until the spat adhering to it has acquired the dimension fit for detachment; from this arises a delay of a year in the growth of the specimens.

Not to neglect any of the points of view from which fecundation may be regarded, we shall add that it appears capable of application to:—

1. The introduction and acclimatisation in our waters of unisexual species of oysters, such as the Dakar and American oyster.
2. The formation of districts on different parts of our coast, which are known to be suitable.

These works of stocking would not present any difficulties, and would not involve heavy expenditure. If

at the mouth of one of our rivers, the Charente and the Adour for instance, with which we are most familiar, were established basins for hatching and incubation, if during three months there were turned into these reservoirs the fertilised products of some thousands of oysters, and if the embryos resulting therefrom were allowed to be dispersed freely over the river, if collectors, tiles, stones or shells have already been placed in the bed of the water-course, then very soon a bank of oysters would be formed. And if the operation were repeated for two or three years, this bank would become sufficiently important to be the object of a regular and productive undertaking.

REARING.

Our experiences in production were supplemented by the necessary study of the question of rearing. There is now a certainty of never being in want of the spat of Portuguese oysters. The *parqueurs* of Verdon who supply it have but one object, the disposal of the mass of spat which they are bound to collect on the return of the spatting season. Arcachon takes a considerable quantity of it, and we shall not omit to show that its employment promotes utilisation of districts supposed to be unproductive, as well as of *parcs* which have been abandoned after being discovered to be unfit for the ordinary oyster.

Rearing is conducted still on some concessions on the Isle of Oléron, and in some *claires* of the Seudre and La Rochelle. But the spaces devoted to this special industry are necessarily very limited, for no matter how favourable may be the report upon the rearing of the oyster of the Tagus, there is no disposition apparently at present to discard for it the cultivation of the French oyster.

It is therefore of importance at once to discover, with a view to handing them over to the activity of the maritime population, situations fitted for the reception of the establishments which we are beginning to miss.

We have cast our eyes, on the one hand, on the coasts of the ocean where portions of the flats still remain unutilised, and, on the other, on the shore of the Mediterranean, where a vast string of lagunes will be found, commencing at the pond of Berre, and with but short interruptions of continuity terminating at the pond of Canet.

As regards the ocean, we shall point out several portions of the coasts of the Charente and the Adour, and particularly certain flats in the valley of the Gironde, where, as at Verdon, there is scarcely any kind of this industry. The opinion of the sailors on this coast is, that the rearing of the oyster is neither possible nor advantageous. This opinion has no foundation; for it cannot be admitted that the Portuguese oyster is not capable of development in a locality so favourable to its propagation. This would be contrary to the teachings of natural history. It was disbelieved also in the lower part of Medoc that at no distant day spat would be collected in the Gironde. In spite of this some intelligent experimentalists have appeared, who have ventured to lay down in the *crassats* of the river some thousands of collectors which have rapidly become covered with small oysters. The example has borne fruit. In the present year some *parqueurs* from Verdon have laid down as many as 120,000 tiles. Next year imitators will be more numerous.

It would be the same with the rearing of oysters if anyone took the initiative in making essays by which it could be proved that the grounds of Verdon similar in

nature to those of Arcachon, where the Portuguese oyster after detachment becomes eatable after a year and a half, are equally suited for the growth and fattening of this mollusc. Until the present time the industry of ostriculture at Verdon has been limited to this: to fish for or dredge every year the oysters accumulated on the *crassats* and the concessions, and to forward them as quickly as possible to the centres of rearing. *

It is true that the attempts made in the direction we are now considering have not been followed with good results. The oysters progressed in the first instance in the *claires* and the marshes, but when they remained for any length of time they soon became sick. What was the cause of their deterioration? Every one who has some experience of ostriculture points out that it is the want of fresh water and the want of change of water; in a word, the absence of oxygen and food in sufficient quantity for the nourishment of the oysters contained in the experimental fish-pond.

On this head let us remark a very characteristic fact. On the banks of the channel at Rambaud there exists a parc organised by the care of the municipality of Verdon, in which are laid oysters collected on the coast. The oysters therein make such rapid progress that we have been able to present to the marine administration some speci-

* We must make one exception in favour of M. Bouchotte, who at Grave Point has created parcs for rearing, which are extremely well managed. But these parcs are not of the same description as those which we desire to see established. Another exception is that of M. Tripota, who has applied himself to a series of experiments, full of instruction and interest, and a further exception is that of M. Peponnet. These are the only persons who have established *claires* for rearing.

mens which in the space of less than three months have passed from the size of three centimètres to that of eight or nine centimètres.

This is the explanation of the phenomenon. The *claire* belonging to the municipality in which the oysters have always been free from epidemic, is situated on a level with the bed of the channel, and receives water twice every 24 hours, except for two or three days, when the water is dead.

We shall now recommend to the enlightened solicitude of the Minister of Marine that works of deepening and cleansing should be executed by the local Commissioners in the channel at Rambaud, and that at Conseiller. The realisation of this wish, in giving to the sturdy and interesting populations of the borders of the Gironde a satisfaction which they have long looked for, would render it possible to attempt at Verdon the rearing of oysters on the spot, and would have the effect of handing over to industry some hundreds of hectares.

Let us pass from the coasts of the ocean to the borders of the Mediterranean. We are here in presence of flats, and immense lagunes which no one has attempted to fertilise. Can it be that the ponds of Berre, Caronte, Gloria, Mauguio, Palavas, Frontignan, Thau, Sigeau, and Leucate, are not suitable for any kind of enterprise? Is human activity unable to put a stop to their sterility? Cannot the industry which is concerned with water, and for which they were apparently created, settle in them and become developed? We have studied in detail the south coast, the dryness of which offers a distressing spectacle, and have visited one by one the stations on its borders, and we have been convinced that it might become the seat of activity and a source of national prosperity.

We felt bound to impart this conviction to the senatorial commission on the re-stocking of waters when we made a report upon the mission with which it did us the honour to entrust us in 1880.

The programme of the present report being limited to a single branch of the cultivation of waters, we shall leave on one side what relates to maritime pisciculture and mussel rearing, and occupy ourselves exclusively with ostriculture. One asks why the magnificent movement which, under the impulse of the maritime administration of M. Coste, determined upon the creation on the coasts of the ocean of an industry in oysters, did not extend itself to the French coasts on the Mediterranean.

Is it that the waters are unsuitable to the valuable mollusc ; or is the soil unable to furnish it with nourishment ?

By no means. The oyster is not a stranger in our southern sea.

There used to be some oysters at Port-de-Bouc, Cette, Rocher d'Agde, Narbonne, &c. Some very fine ones are still to be found, speaking only of the French coasts, at Toulon, and in some of the salt pits of Corsica. We have, moreover, seen established in the roadstead of Toulon a magnificent establishment perfectly arranged and organised which has no need to envy the finest spots on the ocean.

At Cette, in the canal which connects the pond of Thau with the sea, promoters have established floating parcs of very limited dimensions (for the largest measures only 40 superficial mètres), in which more than a million of oysters are annually fattened, and are piled one on the top of the other. It is evident, therefore, that the waters of the Mediterranean possess the properties which the oyster requires for its growth and prosperity.

The principal reasons why the ostricultural industry has not fixed itself on the southern coasts are due, in the first place, to the ignorance in which, for want of example, the maritime populations were sunk as regards the art of cultivating waters ; in the next, to the failure of the first attempts ; and lastly, to the easy prosperity in store for all those occupied in the cultivation of the vine, the silk worm, and the madder plant. Now, however, these times are changed ; various scourges have fallen on our southern provinces and have ruined their wonted industries. A marked emigration movement has shown itself for several years ; the inhabitants quit with regret the land where they were born ; but it no longer will furnish them with the necessities of life. This movement will cease when a new industry furnishes a motive for their activity.

Is it known that ostriculture alone on the ocean shores finds regular means of existence for more than 200,000 persons ? What immense resources would she not offer if she assumed on the shores of the south the importance which the extent of the field for her exercise would imply.

But if example has been necessary on the west coasts, where the cultivation of the oyster has existed from all time, in an imperfect measure, it is true, if, we say, example has been necessary for obtaining the satisfactory result which we have the pleasure of recording, it is all the more necessary on the south coast, where the first elements of oyster industry have always been unknown.

The two examples of Toulon and Cette are too isolated for their action to extend beyond a circle too limited to provoke imitation. It will be asked whether that which succeeds there will succeed equally in the gulf of Marseilles, in the pond of Berre, and in the lagunes of Languedoc and Roussillon. Impressed with the utility of

making essays on the shores of the Mediterranean, we have been authorised by the marine administration to venture some in the pond of Thau, in some ponds in Languedoc, in the gulf of Fos, and in the pond of Berre, which have related specially to the artificial reproduction and rearing of the Portuguese oyster.

Our operations in artificial fecundation practised upon natives of the Gironde have after some mishaps completely succeeded. M. Hardy, the chief of the marine administration at Cette, whom we made familiar with our methods, wrote to us three weeks after the commencement of our experiments, that the fecundation resulted 65 times out of 100 in the formation of a moving *larva*.

This is nearly the average obtained at Verdon. Nothing further remained to be done but to disperse these *larvæ* in a favourable sphere and to place collectors in the vicinity. The rock of Rouqueyrol, situated in the middle of the pond of Thau, having appeared to us a suitable spot, we laid down around it tiles plastered with chalk.

But we did not take into account the marauders, that is, the sea poachers, who in one night succeeded in destroying our plant and breaking up our apparatus.

It was impossible for us to recommence our experiments on account of the lateness of the season when this took place. We cannot doubt, after what we saw, and with our experience in these matters, that one would speedily succeed in propagating the oyster in the Mediterranean by means of the processes of artificial fecundation which we have employed. As respects rearing, we have remarked that the Portuguese oyster accommodated itself very well to the waters of our southern sea; but we shall be unable to obtain the exact measure of the rapidity of its growth until we have made essays in keeping it in cases, a mode of

rearing which seems to us particularly appropriate to these shores, which abound in sea-whelks, deadly foes to the oyster.

Our conclusion is easily anticipated ; it is in conformity with what has been before stated, viz., that ostricultural industry may develop itself and prosper on the French coasts of the Mediterranean.

We cannot bring this report to a close without considering both in a comestible and commercial point of view the mollusc which has been its subject matter. It is known how many detractors it has. At one time some went so far as to demand its extermination pure and simple ; the pretext was, as we have said, the alleged danger to the purity of the race of our oysters caused by its proximity ; but the real reason was the fear that it might take the place of the French oyster in the estimation of the consumer ; in a word, competition. We have disposed of the pretext ; as for the reason, it is no better founded. Has the sale and exportation of the indigenous oyster (let us call it by the name of the flat oyster, for now the Tagus oyster may be termed indigenous), has the sale and exportation of the flat oyster diminished since the appearance of its rival in the market ? This does not appear. Are our ostricultural establishments encumbered with produce which they cannot dispose of ? This does not appear either. The trade is perhaps more difficult to conduct now than formerly, because the number of merchants and producers is greater ; but all oysters, whether reared or dredged, are sold either in France or abroad ; and there are even establishments of note which are unable to execute the orders they receive from all parts.

If the Portuguese oyster is now the object of an important commerce, and if in the present day it takes a

considerable part in the food supply of the public, which is a matter for congratulation, it does not do so to the detriment of the native oyster. Being relatively abundant it is more known, and being cheaper it is accessible to the poor; hence its numerous patrons. Again, are the reasons adduced sufficient to call for an interdict upon a branch of ostricultural industry which is important in the present day? For the sake of some private and discontented interests, must so many brave sailors be reduced to misery, who owing to this mollusc for the first time enjoy some comforts.

Should the unproductive lands which have been converted into parcs of deposit be allowed to relapse into their primitive sterility?

Should the energy be checked which seems destined to bring ostriculture into repute on all those parts of the French coast which are destitute of every industry? And in an economical aspect would there not be heresy in discouraging the production of an article of food on the singular pretext that there is a similar article of a more delicate nature, the production of which it might prejudice? Is the production of rye forbidden because wheat is superior?

Yes, it is said that the Portuguese oyster is inferior to its rival in the matter of flavour. This is possible, but it is a matter to be left to the appreciation of the consumer; it is for him to decide. An administration cannot show preference or be orthodox in matters of taste or palate.

Will it be said that the Americans are devoid of delicate palate because they eat the Virginia oyster, which does not rank above the *angulata*? But it is not merely in America that this oyster has been highly thought of, but in all

Europe, in France, in England, and especially in the north of Germany, whither it is sent either fresh or preserved.

Let us not be afraid to propagate the Portuguese oyster in our waters ; first, because seeing how easily it is raised and fattened, it plays an important part as an article of food ; next, since it will always find a market and sale. If our oyster establishments produced a greater number of oysters, the oysters would be exported in the place of the American oyster, over which they have the advantage of being *parqued* prior to being sent to market. But at the present time we cannot even meet the demands of national consumption. Every year ships go in search of cargoes from the Tagus ; but in spite of this there are so many difficulties in procuring natives in our ostricultural centres that no important purchases of them are concluded without the express condition that so many shall be supplied for 100 Portuguese oysters.

Besides, let us bear in mind that the number of detractors diminishes from day to day, that the cultivation of this mollusc tends to develop itself, and that those growers who devote themselves to it are not those who are the least rewarded. Here is a fresh opening. Let us not forget that we occupy the first place in Europe as regards the industry of oyster culture ; let us neglect nothing to preserve it.

In conclusion, a pleasant duty remains for us to perform ; it is to thank the officials of the Marine for the hearty and enlightened assistance they have at all times rendered us. Our thanks are particularly due to M. de Choisy, *Chef de service* at Bordeaux, to M. Jouau, *Commissary* at Panillac, M. l'Hopital, *Commissary* at La Teste, M. Allégu, *Commissary* at Martigues, and to M. *Commissary*

Sénès. We also are indebted to M. Hardy, *Commis du Commissariat de la Marine* at Cette, for the zeal displayed by him, and the pains he has taken in aiding us and furthering our objects. Finally, we must express our thanks to MM. Curet, *Capitaine de balancelle*, Blanchereau, *syndic*, and Dutemple, *garde maritime*.

Accept, M. le Ministre &c.,

BOUCHON-BRANDELY.





